Railway Maintenance Engineer

Volume 17 CHICAGO—MAY, 1921—NEW YORK Number 5

SUN KINKS

"Sun kinks," often described as acts of God and considered to be beyond the power of man to prevent, should, in the opinion of the writer, be put up to the roadmaster in the majority of cases. Practically every one is due to sheer neglect. The conditions leading up to trouble of this sort should have long before been discovered and corrected by him. They will be found to be the result of either improperly laid rail or the bunching of same, due to **insufficient anchoring.**—Extract from a recent article in *Railway Maintenance Engineer.*

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International
Steel Crossing Foundations

Why Is the Cost of Crossing Maintenance So High?

BECAUSE wooden ties cannot be arranged under crossings so as to distribute the loads into the ballast.

If they are located to carry one track, the other must go unsupported.

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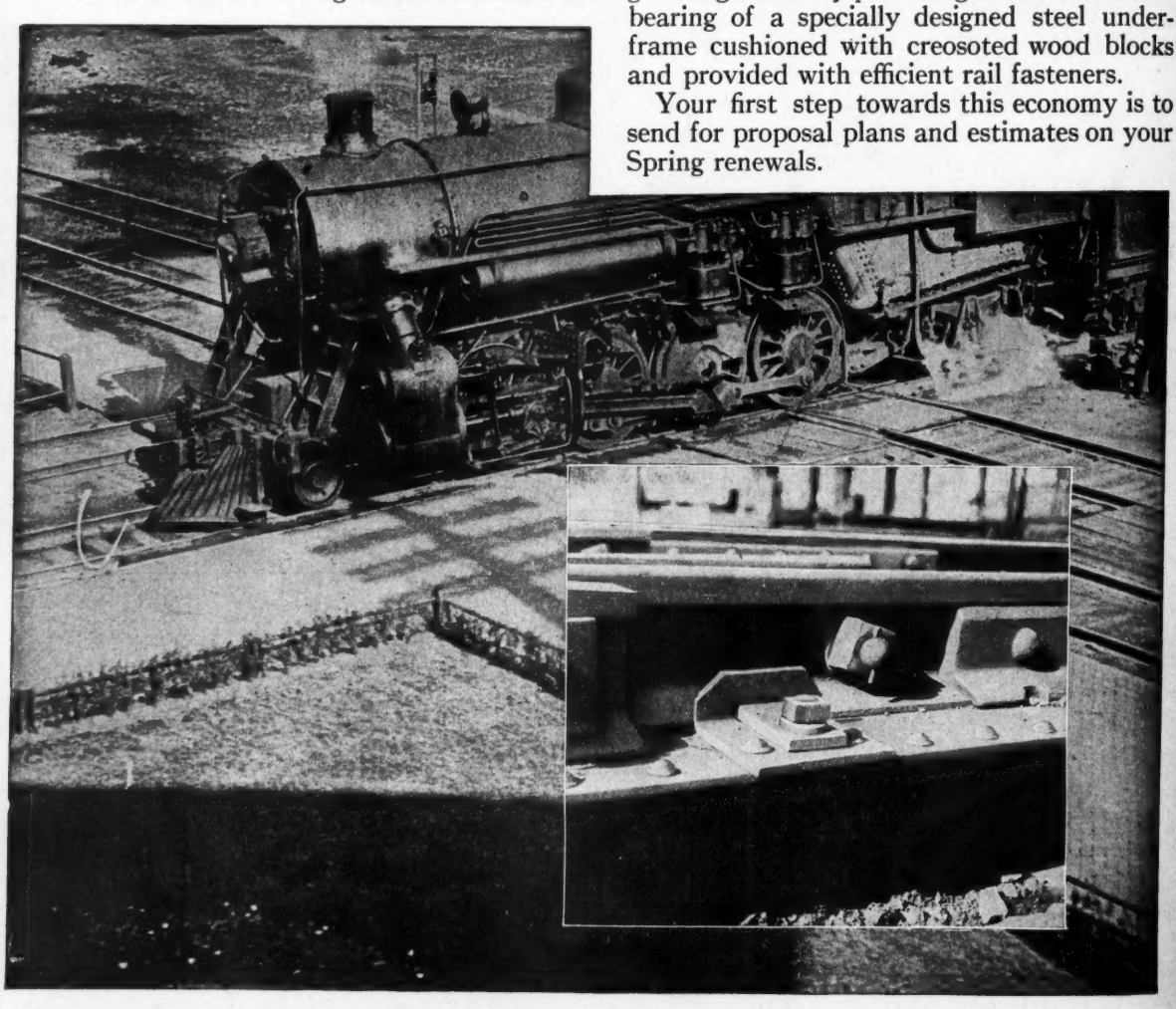

The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

16704 Waterloo Road, Cleveland, Ohio

RAILWAY MAINTENANCE ENGINEER

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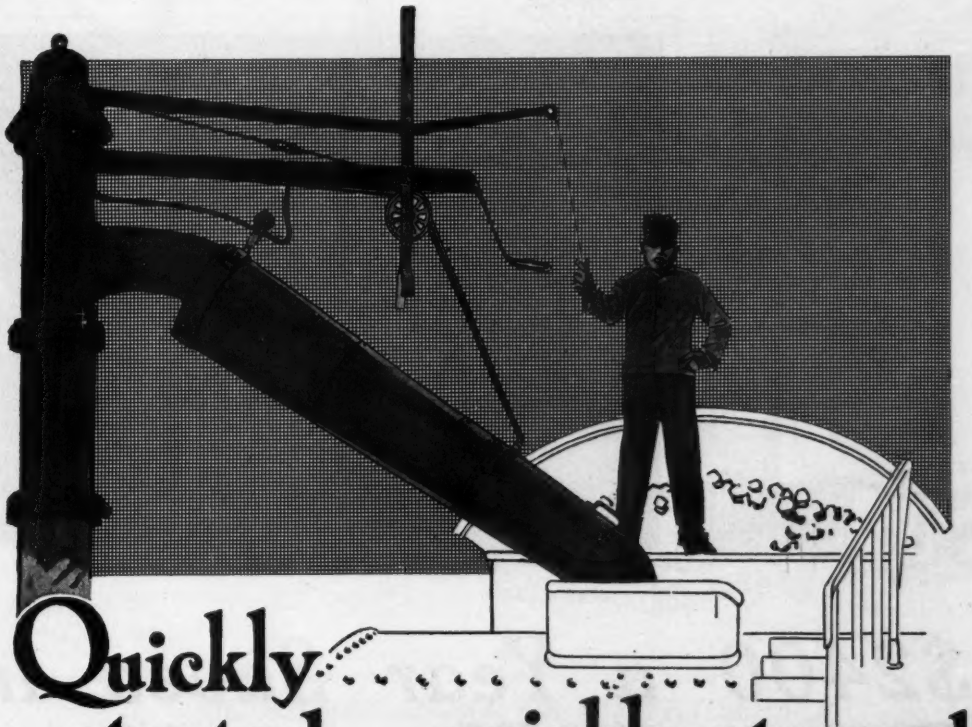

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You want a water column that can be adjusted quickly without spotting the tender.

One that you can use with tenders of different heights.

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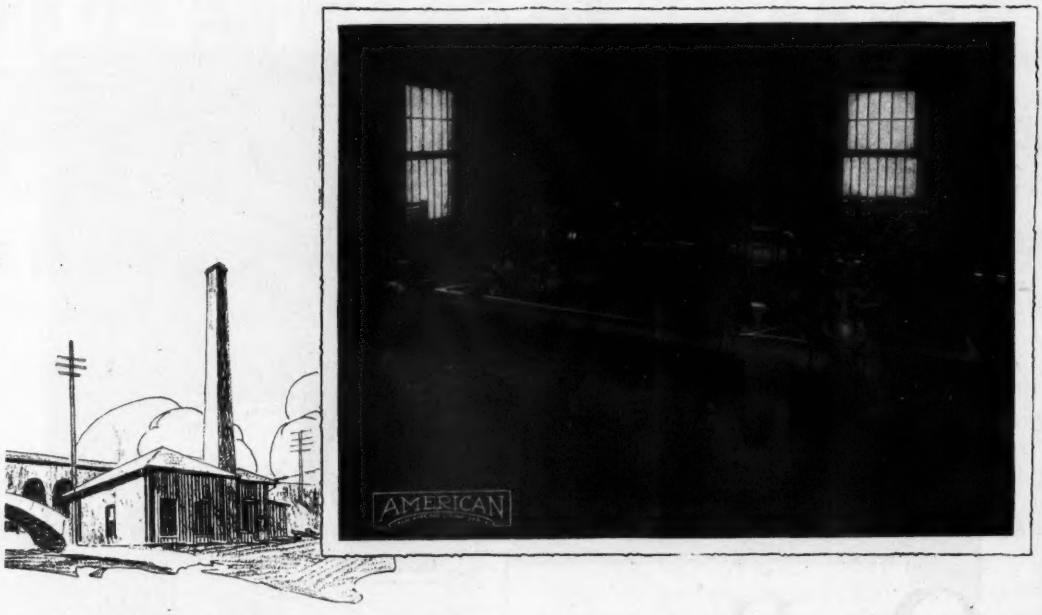

$2400 a Year Saved In Pumpers' Wages Alone

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The American Well Works' installation being automatically controlled—only one man is required as attendant now—and the installation consequently has resulted in saving the Illinois Central Railroad $2400 a year in wages alone.

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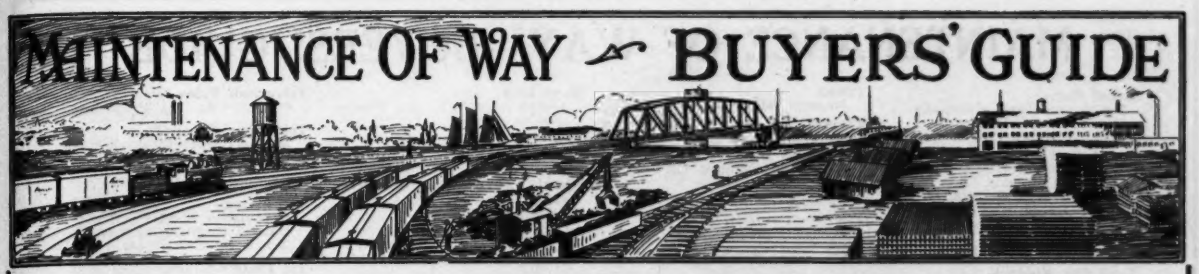

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Republic Creosoting Co.

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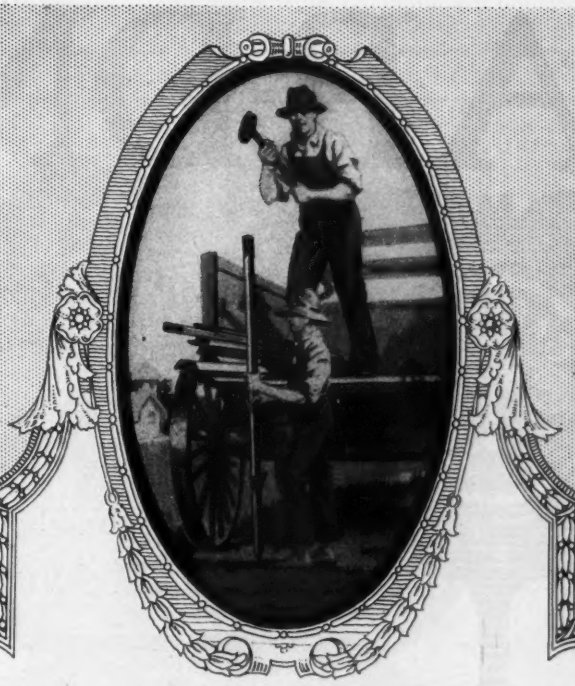
American Saw Mill Machinery Co.

Wrecking Cranes.
Bucyrus Company.
Industrial Works.



The RED TOP Guarantee

WE guarantee RED TOP Steel Posts will not break, burn, rot or frost-heave in the fence line; that they are free from defects in material and workmanship; that they will outlast the heaviest fencing manufactured.

We guarantee RED TOP Posts to be just as represented in our literature and advertising.

Any RED TOP Post which does not fulfill the above guarantee will be replaced by your dealer —without cost or argument.

BROOKE ANDERSON, *Pres.*
CHICAGO STEEL POST CO.

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Quincy, Illinois

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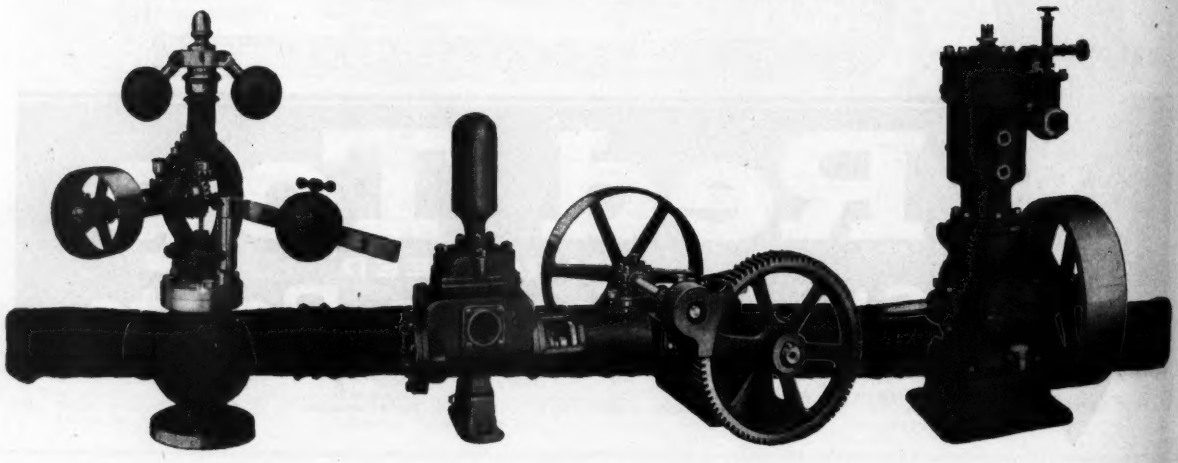

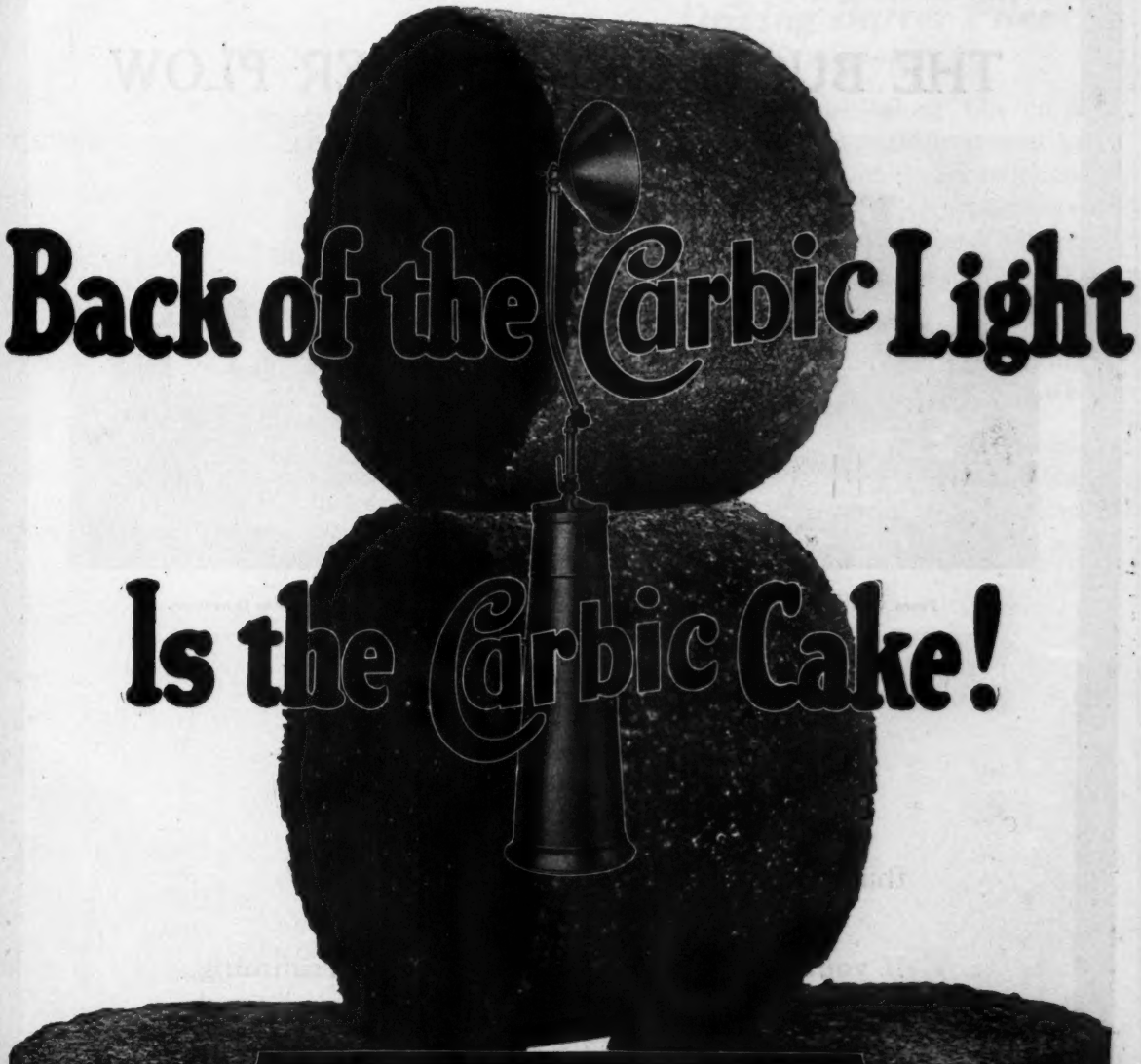

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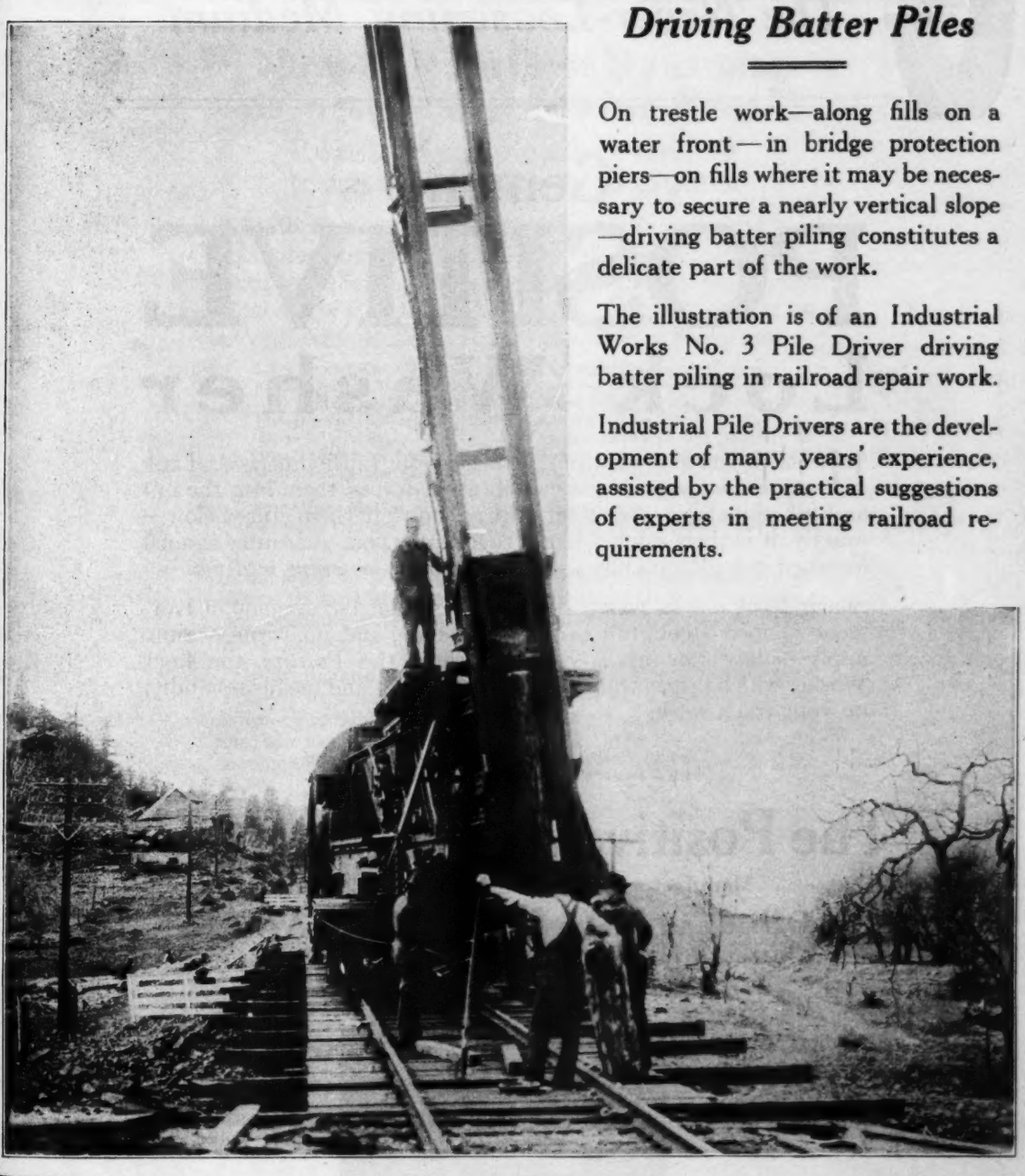

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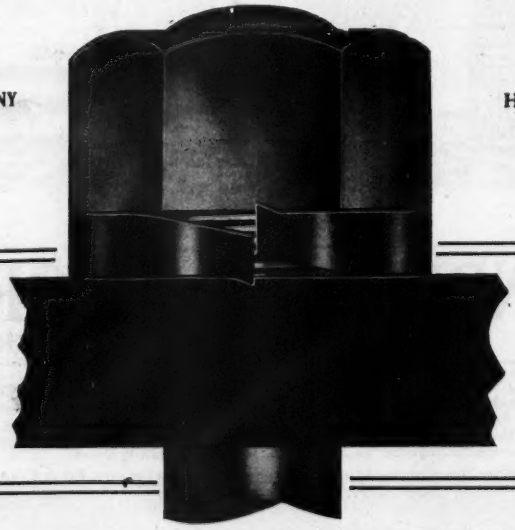

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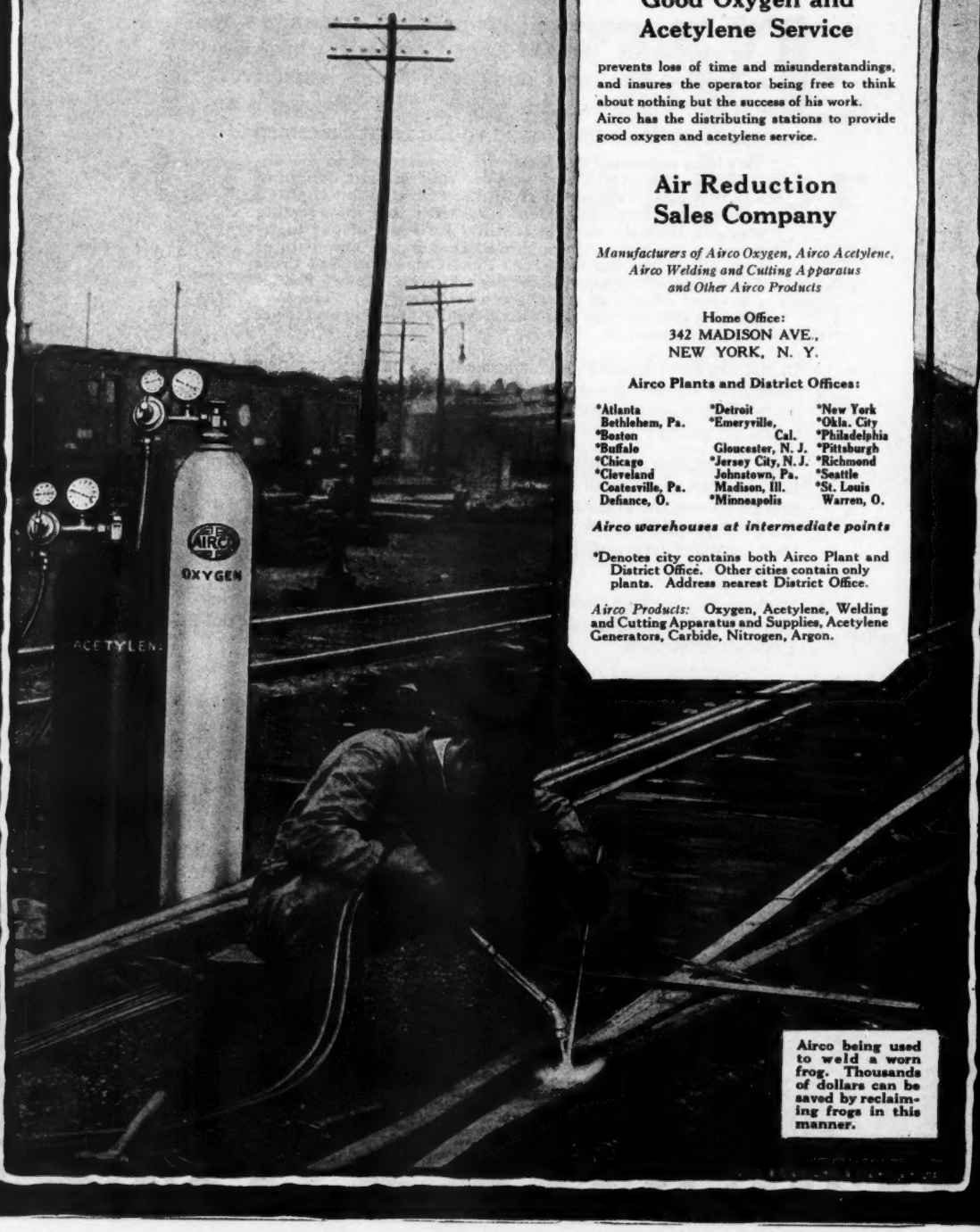

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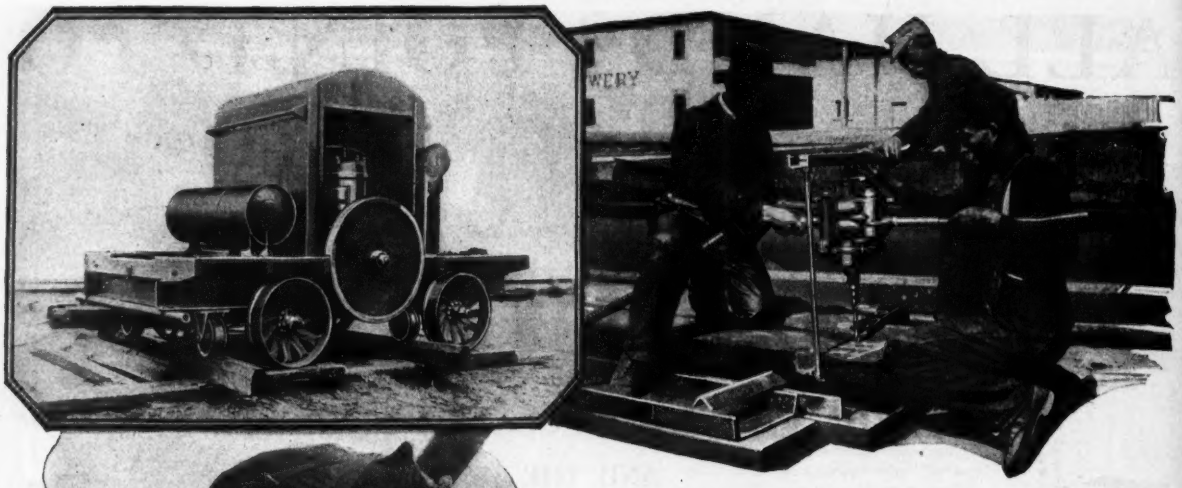

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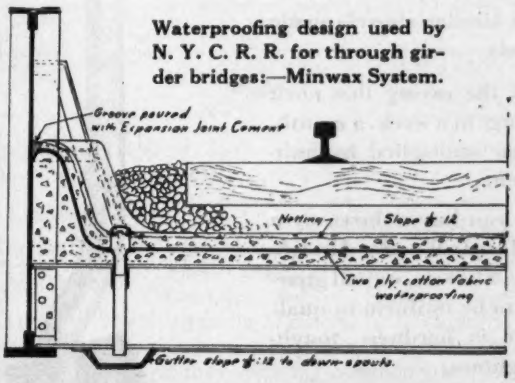
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Notching
Slope ½ 12
Two ply cotton fabric waterproofing
Gutter slope ½ 12 to down-spouts.

Waterproofing design used by N. Y. C. R. R. for through girder bridges:—Minwax System.

Write for Bulletin 21

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Railway Maintenance Engineer

Vol. 17 May, 1921 Number 5

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age* and *Railway Engineering and Maintenance of Way.*)

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Modern traffic is continually requiring more refinements in the maintenance of tracks and structures. The demand for smooth riding tracks for the heavy, high speed trains of today is making necessary the adoption of many practices which would have been frowned on a few years ago as unnecessary. The application of easements to curves is an example. A quarter of a century ago their use was the subject of debate and they were not commonly employed. Today their advantage is so commonly recognized that they are inserted without question, the only point of difference now being in the method of laying them out and this is a question of detail. Every roadmaster owes it to himself to understand the purpose and method of applying easement curves. It is essential that his foremen understand their purpose, their value and the manner of maintaining them, for nothing will interfere with the smooth riding of trains more than the abrupt transition from tangent to curve or the reverse.

Easement Curves Are Necessary

The art of waterproofing is as old as the building of wooden ships and tubs or the thatching of roofs. The use of bitumens also extends back into the mouldy pages of history, but waterproofing as applied to modern construction is not much older than the modern use of concrete. Its rapid development during this period has come through the undertaking of large projects which were dependent on its successful solution. Deep basements have been constructed, subaqueous tunnels driven and a great many structures built to carry railway tracks or street pavements over occupied spaces, requiring protection against the percolation of the rainwater which falls on the deck above. Those who are interested in this subject will find an excellent summary of the problems involved in waterproofing in an article appearing on another page of this issue. The predominating fact brought out in this discussion is that there is no royal road to perfection. There is only one way to obtain success and that lies in the use of good materials with painstaking care and an infinite attention to details. Success in waterproofing is of vital interest to the maintenance officer since proper waterproofing relieves him of practically all responsibility, while ineffective waterproofing will bring him trouble unending.

Waterproofng Means Painstaking

The tool equipment of a typical maintenance of way gang constitutes no small expenditure and this investment is mounting rapidly from year to year as new and more expensive materials and labor-saving equipment are coming into general use. In the early days many workmen, particularly in carpenter, painting and plumbing gangs, furnished most of their own equipment, and under these conditions they naturally gave them the best of care. More recently the transition in the class of men employed on many roads has made it necessary for the employer to furnish a larger part of the equipment, until today the workman

Watch the Investment in Tools

provides practically none of the tools he uses. This change has resulted in a marked rise in the amount of this equipment required. Men are naturally more careless with the property of others and assume an air of indifference which leads to losses of various kinds which mount into large figures in the aggregate. It is probable that the practice of expecting each workman to provide his own tools has passed for good. The only recourse is for the supervisors and foremen to give close personal attention to the uses of the tools provided for the men in their gangs in order to reduce the abuse and subsequent loss to the minimum.

ELECTRICITY IN MAINTENANCE

ALTHOUGH this has been termed the age of electricity and properly so, this form of power has received very limited application in maintenance of way work until recently. However, during the last three or four years the railways have taken rapid strides in adapting it to their varied problems in the maintenance of way department and elsewhere, and the wide diversity of applications which have already been made indicates the large possibilities for this form of power when fully developed.

Because electricity is dependent on some source of generation, its utilization was at first limited to the vicinity of the larger terminals and other communities along the line where central station energy was available. At such points it has been employed to operate water and coaling stations, draw bridges, air compressors for brake testing purposes, etc. For such applications its immediate and constant availability, the elimination of operating cost when not in use, the possibility of remote control and consequent reduction in cost of attendance, are of marked advantage. As electrical service has been extended to the smaller communities its range of applications to railway work has increased correspondingly.

More recently there has appeared a further development which offers many possibilities—the increasing use of alternating current signaling, the power circuits of which, with proper precautions, are capable of adaptation to other uses as well. While this is still in the earliest stages, it holds much of promise. Not only is it possible to provide power for those applications referred to above, but also for the numerous other operations along the right-of-way, such as the lighting of switch and signal lights, the illumination of wrecking and other emergency work, the operation of small construction equipment, etc., all of which have already been demonstrated to be practicable.

A still further development has been the introduction of the self-contained portable gas-engine-driven generator set which can be moved from place to place on a motor car or by other means. Several such plants are now in course of careful development and some of them have already passed well beyond the experimental stage.

Electricity offers many possibilities to the maintenance of way officer. He cannot afford to ignore it, but owes it to his road to familiarize himself with its possibilities and its limitations so that he can avail himself of it when it can be employed to advantage.

PRACTICING WHAT WE PREACH

AS IT IS only too well known, the railroads are still confronted with a large amount of deferred maintenance and have little money with which to carry on the work for 1921. Labor conditions are, however, improving and the prospects are that they will continue to become better. Such influences as the abrogation of the national agreements will tend to improve the financial condition of the railroads. Yet what money there will be available will be, at best, small when compared even to normal requirements. The obvious requirement is then that every dollar spent must be expended to secure the greatest return possible. Since new material is of value only to the degree that there is sufficient labor forthcoming to make use of it and since labor is practically the largest item in the present cost of work, it is natural to search for possible economies in the utilization of that labor. With labor plentiful and railroad labor receiving considerably more than the average wage in outside industries, even after allowing for the reductions now asked for, there is a fair possibility to secure some increase in its efficiency. These two factors alone, reduced wages and more efficient forces, will do much toward the betterment of the track. There is still another important factor contributing toward more and better work and that is the effective utilization of modern track machinery and equipment. Since the increased use of labor-saving machinery has been largely attributable to the labor shortages of the past few years, little has actually been learned of the possibilities, advantages and results which can be obtained from its use from the standpoint of economy, even where such equipment is in regular use.

The problem is, as ever, to secure more work for less cost. In this respect, the tamper, the locomotive crane, the motor car and many other classes of equipment offer numerous possibilities for remunerative study. These devices are all used to varying extents on most roads, but it is an open question as to whether they are used in the most efficient manner.

If it takes four men an elapsed time of one and one-half minutes on the average to tamp a tie in rock and one-half minutes on the average to tamp a tie in rock ballast and then move to the next, an extra minute spent over each tie represents a 66 per cent increase in the labor cost. Unless definite data is collected showing the time required to tamp a tie under various conditions and classes of ballast, etc., it becomes very easy to "kill" an additional minute or even more at this work, and the resultant waste is difficult to check up. The maximum economies in maintenance work will not come until all

I BELIEVE

"I believe in the stuff I am handing out, in the railroad I am working for, and in my ability to get results. I believe in working, not weeping; in boosting, not knocking; and in the pleasure of my job. I believe that a man gets what he honestly goes after, that one deed done today is worth two deeds tomorrow, and that no man is down and out until he has lost faith in himself. I believe in today and the work I am doing, in tomorrow and the work I hope to do, and in the sure reward that the future holds. I believe in courtesy, kindness, in generosity, in good cheer, in friendship and in honest competition. I believe there is something doing somewhere, for every man ready to do. I believe I'm ready—right now."—*Adapted from the Gateway Magazine.*

classes of labor-saving equipment have been subjected to close study and their possibilities have become thoroughly known understood and applied in actual practice.

KEEP YOUR EYE ON THE SWITCHES

A SECTION foreman has no more important or responsible duty than the maintenance of the switches in his main tracks. Every switch is a potential danger point. Even with the best maintenance, it is a source of weakness. It requires continual watchfulness, for even a slight defect or lack of adjustment may give rise to serious consequences.

The problem is first of all one of design. It is not enough that the parts shall have been of adequate strength at the time the standard was adopted, but it is the duty of the maintenance officers to see that the standards are revised to keep pace with the increasing severity of operating requirements. The location of the derail at Porter, Ind., 311 ft. back of the crossing was probably ample for the slower and lighter trains of 20 years ago, but the accident on February 27, when a train ran on the ground so far beyond the derail that the third car back of the engine stood on the crossing and 37 passengers were killed, demonstrated conclusively that it is insufficient today, and that the derailing designs had not kept pace with operating developments. Once designed, the installation and maintenance of a switch becomes the responsibility of the section forces. They must realize the serious results which may result from a seemingly slight lapse in care.

DO MORE SPOT PAINTING

EVERY maintenance officer, whether he is the system head of the department or a paint foreman, knows that a coat of paint applied over badly rusted steel, even though every reasonable effort has been made to brush and scrape off the loose scale and dirt, will not last as long as paint applied over a surface that is still covered with a coat in reasonably good condition. For this reason it is common practice to spot paint those portions of a structure that indicate more rapid deterioration of the paint coating and thus extend the interval between complete recoating.

This is an excellent practice which has saved the railroads a large amount of money and many years in the lives of their structures. While there can be no doubt as to the wisdom of maintaining a painting schedule in so far as this is possible in the face of imperative curtailments of expenditures, many roads will no doubt find it impossible to carry out the complete programs this year. Some appropriation, however, will be made and the question arises as to the disposition of this in a manner that will insure the greatest amount of good. A study of this problem would seem to point to a larger measure of spot painting than would be considered appropriate in a normal year's work. This will mean, of course, that the labor cost per gallon of paint used or per square foot of bridge surface covered will be much higher than if a larger proportion of the bridges were painted complete. It will also mean that a larger proportion of the bridges will have to come up next year or the year following for complete repainting, but these questions are seemingly of minor importance compared with those concerning the permanent protection of the structures and the minimum expenditure in the long run for their protection. The important thing now is to keep as many structures as possible in a condition so that they can be completely repainted in a satisfactory manner as soon as the funds are available and without the necessity for erroneous expenditures for cleaning. Money spent in cleaning bridges never pays any dividends.

LETTERS TO THE EDITOR

A SCHOOL FOR FOREMEN

Monongahela City, Pa.

TO THE EDITOR:

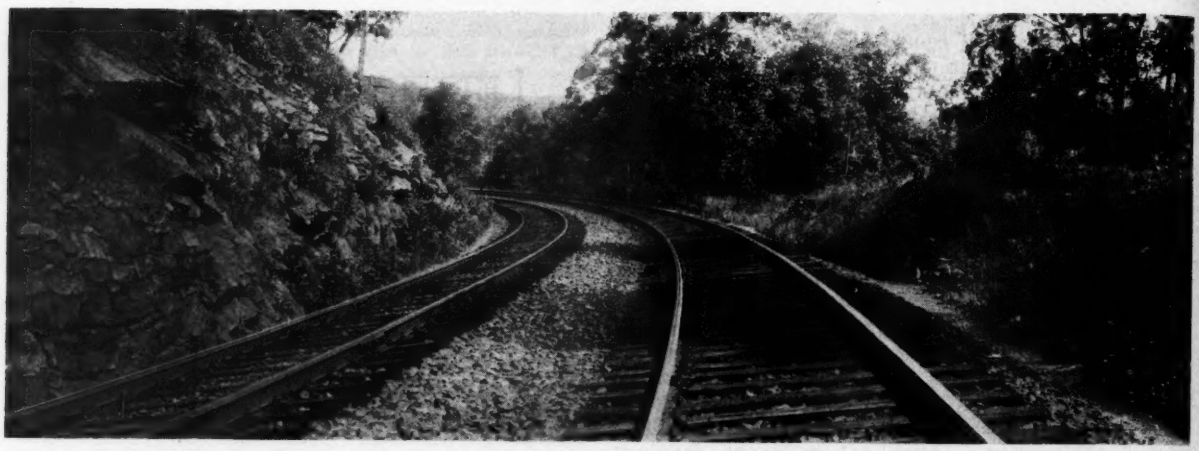
For the past decade at least and particularly since the beginning of the war, we have been surfeited with statistics and illustrations of the ever decreasing efficiency of railroad labor. For some time past, due to the stringent economic conditions, an increase in man output has been reported from many sources, but an increase in the quality of this work, particularly in maintenance of way work, has not been noticeable. This means that enormous quantities of all kinds of track material the country over are being ruined or having their period of service shortened, together with the introduction of many elements of danger, due to faulty and careless methods of installation. A comparison of present day foremen with the old type will disclose one of the most important reasons for this deplorable condition.

Track work is not unskilled labor. Installing rail and switches under traffic, even the use of such apparently simple tools as the spike maul and the tamping bar, require training and skill. It is therefore reasonable to call track work a trade, at least the supervision of it. Since it has been found feasible to substitute trade schools for the older system of learning by apprenticeship in the case of practically all other trades, it is only a question of time until schools for track foremen will be established.

Such schools could be established at a convenient point on the particular railroad and continued for a period, say, of two or three months each year during the winter season when track work is at a low ebb. A raw recruit will not become a foreman capable of coping with emergencies during the period of such a course, but having made a careful selection of the candidates from intelligent men, with at least six months' experience on a section gang, it is reasonable to expect that they can be given the foundation now otherwise almost unobtainable.

For the track work several experienced and capable supervisors and foremen could be selected for instructors. Oftentimes such men can be found who are physically disqualified for road work, but who are admirably equipped for this instruction. These men could instill the theory by lectures, assisted with demonstrations by men selected for their expert use of the tools involved. The candidates would then be required to use each tool himself.

The work outlined above would constitute the body of the course, but it would not stop there. Lectures should be given on a variety of vitally associated topics, such as handling men, "Safety First," properties, use and reclamation of materials, standards, preparation of reports, wrecking, *Americanization* and last, but certainly not the least, the railroad problem. Here exists a wonderful opportunity to talk to these future leaders of the most numerous class of railroad employees on the railroad situation and to arouse their enthusiasm and interest. If railroad officers fully realized with what ridicule the many bulletins they issue are oftentimes received by the laboring men, regardless of the truth they contain, they would either stop publishing them or use other means for imparting this information. Here, however, with the aid of the personal touch, matters could be explained in a way that would not only make a lasting impression upon the men themselves, but would be imparted to all with whom they would later come in contact. CHARLES WEISS.



DEVELOPING THOROUGHNESS AND PERMANENCY

The Engineering and Maintenance Methods of the Lackawanna Follow a Consistent Plan of Procedure

THE EFFICIENT maintenance of a railroad is largely dependent upon proper organization, sufficient supervision and careful consideration of equipment, materials, physical conditions and track characteristics. In this respect the Delaware, Lackawanna & Western has been one of the foremost roads in maintaining a high standard of tracks and structures. Much of this is the result of a consistent plan of maintenance procedure based on a study of the factors of track life and the measures necessary to secure the maximum results in thoroughness and permanency of that structure. While during normal times the Lackawanna is quite able to spend large sums on maintenance work, the question of economy in work and materials is carefully considered at all times. Thus this road has adopted and put into general use various classes of labor-saving machinery for the conservation of man power, while a large maintenance shop has been developed to help secure economy in materials.

The Lackawanna operates about 956 miles of line, including the 396 mile main line between Hoboken, N. J., and Buffalo, N. Y. There are also approximately 543 miles of second track and some third and fourth track. The total miles of tracks operated aggregate about 2,677, of which approximately 1,000 miles consists of sidings, etc. The road is very intensively operated and carries, during a season of normal traffic, from 26 to 30 million gross tons of revenue freight or from five million to nearly six million revenue ton miles per mile of road. This latter figure is more indicative of the traffic handled when it is considered in comparison with the general average of the entire country or, for that matter, the eastern region alone. It is about 2½ to 3 times the average for the country and nearly double that for the eastern region.

Running through semi-mountainous country in certain sections the Lackawanna has had to contend with the problem of relatively heavy grades and sharp curvatures, further intensified by the fact that it maintains a fast passenger service. While numerous projects in the form of cut-offs, reductions of grade, etc., have been carried out the Lackawanna still has many stretches of track containing curves varying from two to eight degrees in curvature and with superelevations as high as 7½ in.

The freight carried by this road consists chiefly of manufactured products and anthracite coal. For the past two or three years the percentage of coal carried has been about 40 per cent of the total revenue tonnage.

The main line between Hoboken and Buffalo is constructed chiefly with 105-lb. special D. L. & W. section rail laid with screw spikes and heavy tie plates on creosoted ties. Rock ballast is used practically throughout on the eastern end and as far west as Binghamton, N. Y., a distance of about 200 miles. The western end has stretches of washed gravel interspersed with rock. The branch lines are laid generally with 80, 91 and 101-lb. rail, a large part of which has been released from the main line. This is laid chiefly with screw spikes and tie plates on creosoted ties in a manner comparable with that for the main line. A few stretches have been laid with cut spikes. The ballast is chiefly cinders and some washed gravel and stone. All tie renewals on the main line and to a great extent on the branch lines and sidings are made with creosoted ties.

Distinctive Form of Organization

The organization of the engineering department of the road varies from that found on most roads. It can neither be called departmental nor divisional for it is more of a combination of the two with departmental inclinations. All work, whether engineering, construction or maintenance, is under the direction of the chief engineer. Reporting to him are the principal assistant engineer in charge of track construction and maintenance, the bridge engineer, the signal engineer, the concrete engineer, the architect and the division engineers. Each of these officers, with the exception of the division engineers, heads his own department and acts independently and without relation with the others except where such relation is necessary or beneficial. With the exception of the principal assistant engineer and the division engineers who have charge of the maintenance of bridges and buildings, all are concerned almost entirely with new construction. Contrary to the usual practice the roadmasters on the Lackawanna do not report to or work with the division engineers, but report to the principal assistant engineer. The division engineers are also concerned with new construction and in addition to maintaining all bridges and buildings supervise all water service work.

As stated at the beginning, the basic idea of the maintenance practices of this road is the creation, as nearly as possible, of a state of permanency in the track structure.

This has led to a series of developments in track design, construction and methods, all of which have been steps forward in attaining this ideal. At the beginning the tie was considered the main or limiting factor or track life. After extensive studies of the life of various woods treated and untreated, and laid under various conditions and classes of traffic, etc., it was decided that when suitable woods were used, properly treated and protected from mechanical wear, they should give a life of at least 16 years. From 1910, the actual commencement of the program for the use of treated ties, the Lackawanna has since made all main line renewals and laid all new tracks with creosoted ties. On the main line, white oak, red oak, beech, birch and maple are used on curves and tangents where there is a heavy traffic while long leaf yellow pine and other miscellaneous woods coming under the classification of soft woods are used on main line tangents where the traffic is lighter and on branch lines and sidings.

TREATED TIES GIVE EXCELLENT SERVICE

As a sidelight on this use of treated ties the following figures are of interest. In the fall of 1920, as a result of the renewal program, approximately 3,957,697 out of a total of 7,340,160 ties in track were treated. Out of this total number, applied over a period of ten years, only about 13,910 ties have been removed. Of this number only 251 were removed on account of decay and 3,171 on account of mechanical wear. The remainder were taken out because of wrecks and derailments. However, about 90 per cent of the ties removed on account of mechanical wear, wrecks and derailments, etc., were utilized in sidings and industrial tracks and for numerous other miscellaneous purposes in section and bridge work. In the past the Lackawanna purchased a great many ties along its own lines, the woods purchased being in most instances, white oak, red oak, chestnut and a few other miscellaneous hardwoods. In addition it has and still is purchasing other woods necessary to meet its tie requirements and for the purpose of making tests. For its experiments this road has obtained woods from the various parts of the United States, Canada, Mexico and many South American countries. The ties thus obtained are inserted in track and records kept of the results obtained. Dating nails are used in all treated ties as they are installed in track.

All ties when received are shipped to Paterson, N. J., where they are treated under the direction and supervision of the principal assistant engineer. The plant is capable of handling about 500,000 ties a year in an economical manner. Bridge piling and other timbers as well as ties are treated. The treatment given is the empty cell or Lowry process. Ties 6 in. and 7 in. thick are treated with an average retention of 2½ and 3½ gal., respectively.

In order to secure an even treatment and a thorough protection of the wood, all necessary work on the ties is performed before treatment. This work includes adzing them for a 1 to 40 cant and boring them for screw and cut spikes. Automatic machines are used for this purpose, the machines, of which there are two, being installed in buildings used solely for that purpose. The ties which have been thoroughly seasoned in the yards at the treating plant, are delivered to these machines on tram cars, mechanically dumped on a table, from which they are placed on the machine conveyors. After they have been adzed and bored they are deposited by the installation on tram cars set on the end opposite from the receiving end. They are then forwarded to the retorts where they receive the treatment mentioned, after which they are stored or shipped according to the needs of the road. In treating switch ties complete sets are kept together and treated, stored and shipped as sets. Hardwood ties intended for insertion in track where there are heavy curves and heavy traffic are bored for four holes at each end. Other classes of ties are bored with two holes.

Standard Construction on Test Ties

Note the Covering of Crude Oil, Also the Lack of Any Cutting Into the Ties, Although They Afterward Proved Unsatisfactory

At approximately the same time that the use of treated ties was decided upon the Lackawanna began the use of screw spikes and heavy flat-bottom tie plates. Considerable difficulty was encountered at first in obtaining a tie plate that would permit of being rigidly fastened to the tie and yet permit a sufficient amount of play between the rail and the plate without causing undue wear and strain on the plates and the screw spikes. Subsequent developments ended in the adoption of an extra heavy flat-bottom tie plate, measuring 7 in. wide, 11 in. long and ¾ in. thick. Lugs are provided of sufficient height so that the screw spike may be run down firmly while at the same time leaving a space between the rail flange and the spike head. The holes through the plate are punched slightly back of the shoulder in order to prevent the neck of the spike from being cut by the base of the rail. Three spikes are used on all curves carrying a heavy traffic, while in some instances where the conditions are especially severe, this construction has been augmented by the use of hook shoulder tie-plates bolted to the tie.

With the ties thus protected from decay and mechanical wear the limiting factor of life hinged on the rail, the joint and the tie plates. In accordance with the demands of its increasing traffic and the need of a more rigid track structure, the Lackawanna adopted a 105-lb. rail of special section and six-hole joints. The problem of rust and cor-

rosion was met by thoroughly oiling all metal connected with the track structures. Thus, once every year, generally in the fall after the track has been put up for inspection, the rails and fastenings on every part of the main line and important branch lines are sprayed with a crude oil containing about 45 per cent asphalt. This is applied by means of a special oil spraying car attached at the head of a train of tank cars and a locomotive. The car is equipped with air compressors, tanks, sand boxes, rail wipers, oil strainers, headlights, speedometer, air brake controls, pressure gages and other controls, etc., necessary in the operation and control of the train and the spraying. The oil is heated in the tank cars through the medium of steam supplied by the locomotives, a temperature of 175 deg. F. being maintained. The proper flow of the oil is secured by air pressure, a 60-lb. working pressure being maintained at the nozzles. The machine is so arranged that every part of the rail with the exception of the tread, is thoroughly coated by the spray, which includes in its range all fastenings, etc., to beyond the limit of the tie plate. The rate of application can be varied at the will of the operator, but the usual application is about 85 gal. per mile of track, made with the car traveling between 25 and 35 miles an hour. All switches, crossings, etc., not reached by the special car are sprayed by the section forces.

MAINTENANCE WORK IS PLANNED CAREFULLY

While the usual program has been somewhat disarranged due to the natural readjustments following government control and the attendant financial stringencies due to that and to the slump in traffic, the Lackawanna has endeavored to follow as nearly as possible the methods which it would ordinarily employ. Before the end of each year a complete budget is made up, specifying the amounts of materials required, such as rail, crossings, ties, etc., the locations at which this material is to be used and the time when it is to be delivered. By the first of the year it is usually possible to have all the material necessary for the work to be done during the early part of the coming year on hand or distributed along the main line. All track materials, such as rails, etc., are distributed as early after the first of the year as possible and every attempt is made to lay such rail before the first of April or May. This practice enables the road to use its winter forces for this work, and has the further advantage of making it possible to start immediately after the rail laying is completed and at about the proper time of the year on the renewal of ties, the overhauling and tamping of track, and other similar matters which are usually scattered throughout a normal season.

The maintenance plan calls for the thorough overhauling of every alternate half-section of track each season to put it into the best possible shape, while only such work as is absolutely necessary is performed on the other half section for that year. The following, which is a part of the instructions issued to section foremen at the beginning of the year, illustrates the method followed:

"Each foreman will start at one end of his section on main tracks, removing all shims as placed during the winter, tamp up all loose ties, pick up all low spots. line all track that is out of line, tighten all loose bolts, working over his entire section, this to guarantee smooth riding track before proceeding with the regular summer maintenance work, renewal of ties, etc. After this work has been completed the section foreman, under the direction of the roadmaster or supervisor, will start on one end of his section and make a complete renovation of one-half of his section during the summer season. The portion of the section requiring the larger amount of repairs, tie renewals, ballasting, surfacing, etc., should be selected for the year's renovation.

"Foremen will remove all ballast on this portion of the section, retie, resurface and reline, fork or screen all stone or washed gravel with forks or screens provided for the purpose, back into tracks, dress and place standard shoulder on all ballast as replaced. * * *"

This system insures that at least every two years the main line of the Lackawanna will be overhauled thoroughly and brought up to standard.

All steel is laid under traffic, the new material being distributed alongside of the old by the use of unloading machines and other devices, while the old rail released from track is loaded into cars in a similar manner. This work is usually done by the regular section forces, reinforced whenever necessary by extra gangs of from 30 to 100 men, all equipped with the necessary labor-saving equipment and work trains, etc., to conduct the work efficiently.

In the general maintenance procedure, all track sections or territories are divided and laid off on an equated basis in order to equalize the duties of each gang and to form a comparative basis upon which to determine charges, etc. One mile of main track is assumed as the basis in this method and at the present time the forces are allotted on the basis of one man per mile of equated track for an eight-hour day or of ¾ man per mile of track on a 10-hr. day.

As a rule, the main line sections are approximately three to four miles long with section forces of 6 to 10 men. Density of traffic and high speed of trains are taken into consideration when making up the reports on the individual sections. Through the use of the equation with compensating features for traffic, etc., it has been found possible to secure a much fairer comparison between the work at various points along the line as well as forming the basis for a more satisfactory study of maintenance costs. The following are some of the equated values used by the Lackawanna, the amounts given being equivalent to one mile of main track:

1 mile of second, third and fourth track.
2 miles of passing siding.
3 miles of other siding.
5 railroad crossings, interlocked.
12 bridges, interlocked.
8 slip switches.
10 switches, all other.
20 derails, interlocked.
20 highway crossings.
40 farm crossings.
20 miles of right of way fence.

MUCH LABOR-SAVING EQUIPMENT IS USED

Every alternate section is equipped with a four-tool pneumatic tie tamper, which is also used by the adjoining section, the section foremen in charge so laying out their work that it does not interfere with the interchange of the equipment. In this way one section gang is able to space ties, clean and dress the ballast, tighten bolts, clean ditches and do such other necessary work as does not require the use of the tamper, while the adjoining gang picks up low spots, makes slight raises in track and tamps the ties. Altogether there are approximately 100 of these tie tamper outfits in service. Where they can be utilized economically the section foremen are also furnished with motor cars and trailers and to date about 35 per cent of the sections are so equipped.

In addition to the regular tie tamping equipment the Lackawanna has developed a portable outfit for use on special, emergency and other classes of work and covering a broader application of the use of compressed air for the handling of tools. This outfit consists of a variety of tools and a special steel box so arranged that the tools can be easily handled or shipped from point to point within a roadmaster's division. The box contains both wood and metal drilling machines, templates, air-driven rail saws, adzing machines and pneumatic wrenches for the running up and tightening of screw spikes and such other miscel-

laneous pneumatic tools as are found necessary in track work. Each division is also furnished with other labor-saving equipment, such as rail loaders and unloaders, ditchers, spreaders and locomotive cranes.

A COMPLETE AND WELL EQUIPPED MAINTENANCE SHOP

In the interest of economy no scrap material is sold or thrown away until it has passed through the maintenance and reclamation shops at Dover, N. J. In order to facili-

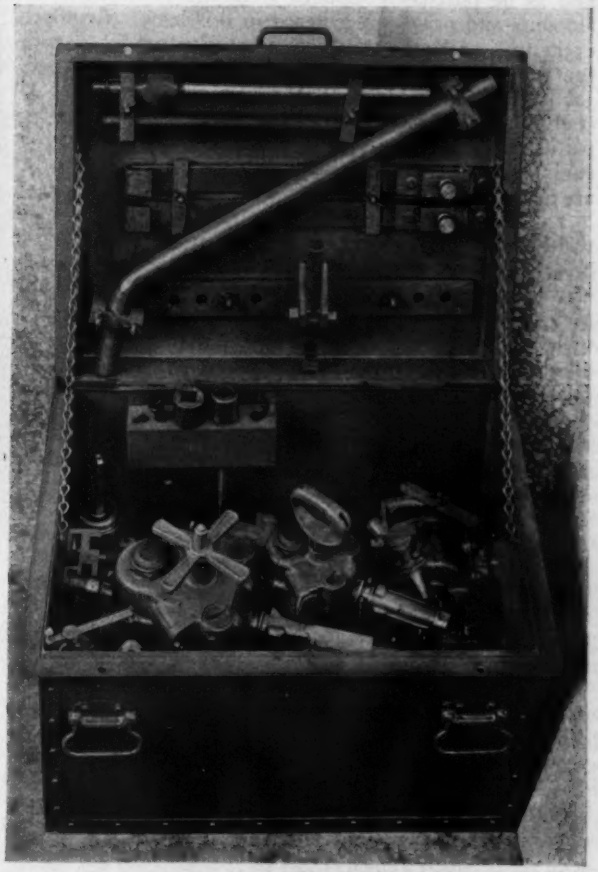
The Front End of the Oil Spraying Car

tate the collecting and sorting of the scrap, each section is furnished with a storehouse for the storage of tools, etc., to the side of which has been added a large scrap bin, the sides of which have been made sufficiently high so that a large amount of material may be stored there without appearing unsightly. This is gathered up from time to time and shipped to Dover on regular shipping days, where it is sorted into classes and whatever possible reclaimed. Altogether about 35 per cent of this so-called scrap is put back into service. In addition to the extensive reclamation work which is carried on at the shop, there is a large amount of new material constructed according to the railroad's design. All of the frogs, switches and switch stands, etc., used on the Lackawanna are made at this plant, much of the reclaimed material going into this class of work.

This shop also serves as a base of supplies for the maintenance of way department since all new materials, whether purchased outside or manufactured by the shop forces as well as such surplus and repair parts as are not used in conjunction with other departments of the railroad, are stored here for shipment as needed. All ditchers, spreaders, rail unloaders, etc., are concentrated at this point during the off-season, when they are given a complete overhauling in the shops and put in readiness for the coming year's work. Motor cars and tie tampers are handled in a similar manner, a small shop having been assigned for this particular purpose. Light repairs for the latter equipment are made during the working season by traveling supervisors, but all heavy work is sent in regularly to the shops. Such work coming in for heavy repairs is given a thorough overhauling as a part of the desired plan of going over all equipment annually.

In order to handle the various problems that come up from time to time in maintenance practices, as well as to try out new devices and ideas, etc., a stretch of the main line through this section has been set aside as a test track. In addition, a complete installation of the various types and sizes of switches has been made on a small plot of ground adjoining a storehouse, the second floor of which has been taken over as a conference room where the principal assistant engineer and his subordinates may meet. Regular meetings are held and any misunderstandings as to equipment, installation or other features of the work are thoroughly discussed.

A bridge and building shop is maintained in connection with the Lackawanna's car shops at Scranton, Pa., where



The Special Kit Box and Tools

a considerable force of men is employed framing new work and doing such other work as is required by the bridge and building department.

HANDLING MAINTENANCE OF WAY LABOR

During a normal working season the Lackawanna employs about 4,000 to 5,000 men in maintenance of way work. To handle this force efficiently it has developed its own labor organization. Under its methods the railroad employs a general foreman of labor, who maintains an office in New York City and recruits men as they are needed. They are then sent to Hoboken and from there

they are distributed to the various localities, no charge being made for either transportation or such other costs as are common in ordinary labor "exchanges" or agencies. As a rule, the section foremen furnish their own houses, but in isolated communities the company furnishes quarters for both the foreman and his men. Extra gangs are housed in bunk houses and in bunk cars. These company-owned quarters are furnished complete with kitchen cars and utensils, a commissary and a commissary man, cooks, helpers, as well as light, fuel, hot water, beddings, etc. The cars are of good grade, sealed inside and provided with metal cots, the bedding for which as well as the laundry for each employee is washed once a week at the company's expense. The price of the board paid by the employee is, of course, regulated to some extent by market prices, but this item has been kept at a minimum by the establishment of a central food depot and quantity purchasing. If desired the company will furnish the kitchen car equipment, etc., to the gangs who may then arrange for their own cooks, helpers, etc.

Each employee, as he joins a camp, is given a pass book and as he purchases supplies from the commissary the amounts and prices are entered in this book. Regularly every two weeks the pass book is checked up by a representative of the roadmaster, who corrects it to the satisfaction of the holder and the commissary man. All charges are then passed upon by the roadmaster, who forwards the charges to the office of the principal assistant engineer, where the necessary deductions for board, etc., are made from the pay check.

The Lackawanna has paid marked attention to the widespread use of concrete, the harmonious design of the bridges, stations, etc., and the pleasing appearance of the station grounds. This road has gone very heavily into the use of concrete, replacing its wood and steel structures wherever possible and economical. At the present time all timber trestles have been eliminatd, while very few other wooden structures are still in service. The design of the concrete work is handled by the chief engineer, who supervises and directs the work of the concrete engineer and the architect in securing harmonious and pleasing effects as well as strength and utility.

The question of harmony has been especially emphasized in the construction of all buildings along the main line, the stations in the suburban sections being very attractive. No set standard was followed in this class of structure, the intention being to get away from anything uniform in their appearance. The grounds surrounding the stations are well planted to shrubbery and covered with a well-kept lawn. This work is under the direction of the chief gardener, who supervises the planting and care of the grounds as a part of the maintenance of way procedure.

IRON AND STEEL INSTITUTE REPORTS ON RAIL PRODUCTION

THE AMERICAN Iron & Steel Institute, conforming to its annual custom, has recently issued statistics on the production of rails in the United States. According to its report, 2,604,116 gross tons of rails were produced in this country in 1920, 400,273 tons, or 18.16 per cent more than were produced in the preceding year. Compared with 1917, however, the year of greatest rail production since the beginning of the war, this figure is low by 340,045 tons, or 11.55 per cent.

The production of rails for 1920 and that for each preceding year back to 1906 is given in Table 1. In studying the table it is of interest to note the decline in the production of rail made of Bessemer steel from 3,791,459 tons, or 95.31 per cent of the total, in 1906 to 142,899 tons, or 5.49 per cent, in 1920. In the latter year open-hearth rail comprised 89.63 per cent of the total and miscellaneous steels 4.88 per cent.

TABLE 1—PRODUCTION OF RAILS BY PROCESSES, GROSS TONS

Year	Open-hearth	Bessemer	Rerolled*	Electric	Iron	Total
1906	186,413	3,791,459	.....	.....	15	3,977,887
1907	252,704	3,380,025	.....	.....	925	3,633,654
1908	571,791	1,349,153	.....	.....	71	1,921,015
1909	1,256,674	1,767,171	.....	†	.....	3,023,845
1910	1,751,359	1,884,442	.....	†	230	3,636,031
1911	1,676,923	1,053,420	91,751	462	234	2,822,790
1912	2,105,144	1,099,926	119,390	3,455	.....	3,327,915
1913	2,527,710	817,591	155,043	2,436	.....	3,502,780
1914	1,525,851	323,897	95,169	178	.....	1,945,095
1915	1,775,168	326,952	102,083	.....	.....	2,204,203
1916	2,269,600	440,092	144,826	.....	.....	2,854,518
1917	2,292,197	533,325	118,639	.....	.....	2,944,161
1918	1,945,443	494,193	101,256	.....	.....	2,540,892
1919	1,893,250	214,121	96,422	50	.....	2,203,843
1920	2,334,222	142,899	126,698	297	.....	2,604,116

*Rerolled from old steel rails. Included with Bessemer and open-hearth steel rails from 1906 to 1910 inclusive.
†Small tonnages rolled in 1909 and 1910, but included with Bessemer and open-hearth rails for these years.

There has been an appreciable revival in the production of alloy steels, principally titanium, which had reduced almost to the vanishing point in 1918, as shown in Table 2.

TABLE 2—PRODUCTION OF ALLOY-TREATED STEEL RAILS, 1910-1920

		Production by alloys		Production by processes		Production by weight per yard		
Years	Total production Gross tons	Titanium	Other alloys	Open-hearth and electric	Bessemer	Under 45 lb.	45 and under 85 lb.	85 and under 100 lb.	100 lb. and over
1910	257,324	256,759	565	27,389	229,935	..	70,170	187,154	
1911	153,989	152,990	999	38,539	115,450	..	27,097	126,892	
1912	149,267	141,773	7,494	40,393	108,874	21	5,426	143,820	
1913	59,519	47,655	11,864	33,567	25,952	*01	9,414	50,014	
1914	27,937	23,321	4,616	27,447	490	*14	†1,168	8,301	18,454
1915	24,970	21,191	3,779	24,367	603	*6	†1,977	6,555	16,432
1916	28,562	26,493	2,069	27,675	887	..	†1,761	10,506	16,295
1917	16,535	15,273	1,262	16,535	.....	..	†335	6,671	9,529
1918	3,111	2,891	220	3,111	.....	..	†47	2,640	424
1919	6,476	6,207	269	6,476	.....	..	.....	3,920	2,556
1920	12,909	11,652	1,257	12,909	.....	..	†514	5,069	7,326

*Includes rails under 50 pounds.
†Includes 50 pounds and less than 85 pounds.

The total production of rail, as given in Table 1, includes, in addition to new rails rolled, the rails rerolled from defective rails and from old rail. The total production in gross tons of renewed or rerolled rails so included is given in Table 3.

TABLE 3—PRODUCTION OF RENEWED AND REROLLED RAILS, 1913-1920

	Rerolled from new seconds, new defective rails, etc.			Rolled from old rails	Total rerolled
Years	Open-hearth	Bessemer	Total		
1913	13,052	30,741	43,793	155,043	198,836
1914	13,538	13,234	26,772	95,169	121,941
1915	6,477	2,652	9,129	102,083	111,212
1916	1,711	2,149	3,860	144,826	148,686
1917	1,825	7,182	9,007	118,639	127,646
1918	13,296	19,462	32,758	101,256	134,014
1919	1,933	5,766	7,699	96,422	104,121
1920	19,493	1,979	21,472	126,698	148,170

In Table 4, which shows the production of rails by weight per yard for each of several years, it is of interest to note that the tonnage of the rails weighing 100 lb. per yd. and over forms a larger proportion of the total (28.0 per cent) than in any year since this weight of rail has been recorded separately. During 1918 and 1919 the proportion fell off appreciably because the Railroad Administration bought no rail weighing over 100 lb.

TABLE 4—PRODUCTION OF RAILS BY WEIGHT PER YARD, 1905-1920

Years	Under 45 pounds	45 and less than 85	85 and less than 100	100 pounds and over	Total Gross tons
1905	228,252	1,601,624	1,546,053		3,375,929
1906	284,612	1,749,650	1,943,625		3,977,887
1907	295,838	1,569,985	1,767,831		3,633,654
1908	183,869	687,632	1,049,514		1,921,015
1909	255,726	1,024,856	1,743,263		3,023,845
1910	260,709	1,275,339	2,099,983		3,636,031
1911	218,758	1,067,696	1,536,336		2,822,790
1912	248,672	1,118,592	1,960,651		3,327,915
1913	*270,405	†967,313	2,265,062		3,502,780
1914	*238,423	†309,865	868,104	528,703	1,945,095
1915	*254,101	†518,291	742,816	688,995	2,204,203
1916	*295,535	†566,791	1,225,341	766,851	2,854,518
1917	*308,258	†882,673	989,704	763,526	2,944,161
1918	*395,124	†665,165	888,141	592,462	2,540,892
1919	*263,803	†495,577	965,571	478,892	2,203,843
1920	*489,043	†433,333	952,622	729,118	2,604,116

*Includes rails under 50 pounds.
†Includes 50 pounds and less than 85 pounds.

PRACTICAL METHODS OF WATERPROOFING

Proper Understanding of Basic Principles and Minute Attention to Details Are Necessary for Success

BY A. S. HARRISON,
Vice-President, Minwax Company, New York City

MANY AGENCIES of deterioration and damage affecting both structural integrity and permanence, as well as the appearance and architectural value of structures, have their underlying cause in water and its effects. There is a constantly increasing recognition of this fact among the designers of permanent bridge structures, who realize the importance of the problem and the need of its efficient solution.

It is the purpose of this article to suggest designs which have proved successful in solving some of the more difficult details and to set forth the underlying principles which must be applied to all successful waterproofing design. It is not presumed that the data presented will offer the actual solution to every individual problem, but it is believed that the ideas suggested may aid in arriving at a solution and make for better waterproofing.

THE BASIC FUNCTIONS

There are three basic functions to be accomplished in producing a waterproof bridge structure:

(1) The creation of a continuous and impervious surface, sheathing all areas and surfaces with which water may be held in contact, as decks or roadways, arch barrels, spandrel walls, etc., which will be unaffected by water and the acids or alkalies it may normally carry in solution.

(2) The maintenance of this surface in unbroken and impervious condition under all the variety of conditions of vibration, movement and temperature to which the structure may be subjected.

(3) The provision of proper drainage so that water shall be carried entirely clear of the structure rapidly and directly.

It is possible that the reader will regard these as so obvious as to require no statement, but an experience covering several years in closest contact with these problems indicates that there is need of keeping them constantly in mind; for a thorough and careful application of them, to the design and to the selection of materials and methods, will make for efficient results.

The creation of a waterproofed surface hardly needs amplification. The actual designs themselves will fill in all details, while the requirements imposed upon materials have to do only with initial characteristics and can be fulfilled readily by most of the bituminous materials usually used, if not by the material of construction itself.

The maintenance of this waterproof surface embodies several considerations and a range of conditions that impose requirements deserving more detailed analysis and consideration. As the waterproofing is essentially part of the structure, in order that its efficiency may be maintained it should have a proven life approximately equal to that of the structure itself and shall be so protected that the placing of the ballast, fill or wearing surface of the roadway, or the maintenance of these, shall not result in damage to the system.

As bridge structures are subjected to vibration due to moving loads, to movements from the same cause and from temperature expansion and contraction, the material used, if waterproofness is to be maintained, must not only have sufficient ductility and elasticity at all temperatures to withstand these movements but also to withstand the possible cracking which may result from them. It is probable that such cracking may not occur in some structures, but necessary construction joints and the uncertainties imposed by field conditions during erection mean that in many, if not in the majority, some cracking does occur. From one viewpoint, waterproofing is insurance that when this does occur it will not result in damage or disfigurement of the structure. Considering all factors, it may be stated definitely that there exists today no waterproofing system possessing qualities of strength, permanence and elasticity beyond the possible requirements of such construction, though there are some in which these qualities exist to sufficient degree to meet all requirements thus far developed. A more detailed

analysis of materials in the light of these requirements will be interesting.

There are two general waterproofing systems. The first is the integral—becoming integral with and part of the structural material. On this we have the authority of the Committee on Iron and Steel Structures of the A. R. E. A. in Bulletin 232, page 395, that "the integral method is not recommended for waterproofing railroad bridge floors." The second is the membrane system—

View of a Completed Expansion Joint

the formation of a skin or membrane over the surface or area to be waterproofed. This system offers the efficient solution to the problem and is the one in general use. In this system there are but two subdivisions: first, swabbing coats of bitumen, either hot or cold, which form a skin on the surface; second, a built-up blanket consisting of successive plies of a membrane—cotton fabric, felts or burlap—cemented together with swabbings of bituminous materials.

Of these subdivisions, the built-up blanket is obviously the more efficient. On retaining walls or similar construction the swabbing coat may be relatively efficient, but it has not in itself the qualities of strength and toughness necessary for efficient results under all conditions. To illustrate this point and to emphasize the requirements which efficient waterproofing must meet, let the following conditions be assumed: Contraction is occurring in the slab in Fig. 1. So long as each element of the slab participates normally in this contraction, no unusual strain will be imposed on the waterproofing film (W). Now, assume that failure occurs at "X" in Section "G." A crack forms and the movement previously distributed among all the other elements is suddenly localized at this point "X." The area of waterproofing film affected is initially infinitesimal as to width, but at the end of the movement the crack has assumed a definite width. Obviously this imposes a severe strain on the waterproofing film at this point.

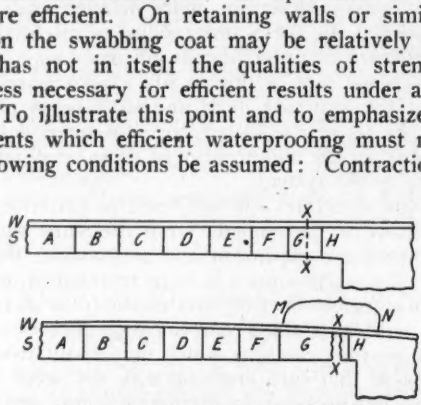


Fig. 1. The Membrane Must Have Considerable Tensile Strength

Now the ability of this waterproofing film to span this crack will depend upon its ductility or its ability to stretch. Here, three factors must be realized: first, that the ductility of bituminous materials varies directly as the quantity involved; second, that they are relatively low in tensile strength; third, that the waterproofing film is held firmly against the slab surface by its bond and by the weight of the protection course, ballast or paving which rests upon it. Therefore, the ability of the film to span the crack, to stretch, will vary directly with its tensile strength, as this value will determine the bulk of bitumen as between "M"—"N," which can be made to function.

The amount of tensile strength actually needed is difficult of determination. It has been variously estimated at from 60 to 200 lb. per in., but it can be stated definitely that high values are desirable, as the pressures holding it against the surface are often great. From this it can be seen that swabbing coats are definitely limited in their efficiency, their tensile strength being only a few pounds, and can function over and prevent leakage through only the smallest invisible checks. Anything more will destroy their efficiency. It can be seen further that the membrane used to reinforce the swabbings should have maximum strength combined with maximum elasticity; both of these values should be as high as possible. An analysis of the membranes available, in view of the facts, will materially assist the engineer in obtaining efficient waterproofing.

Carrying the Waterproofing Over the Abutment

As this system, and all bitumens and membranes built up with them, are of such character that they can be cut and injured in the placing of the back-fill or ballast, as well as by pounding of the ballast or paving material, it should be protected in all cases by a protection or armor coat. For this purpose there are three systems in use, each with individual merits under varying conditions:

Bituminous Mastic—This usually has a thickness of 1 in. to 1½ in., placed in two layers. In using this system, a ply of asphalt or resin-sized paper should be placed over the waterproofing to prevent the bitumen in the blanket being drawn up into the mastic by the heat. Mastic has two chief advantages: it is efficient as a pro-

tection course immediately it has cooled and it can be followed immediately with ballast or paving material; and on shallow ballasted bridges its greater ductility decreases the liability of shattering. It is, however, quite expensive and is unsuited to sloping or vertical surfaces.

Brick—This—laid in either mastic or grout—is efficient and easily placed. It is usually less expensive than mastic and in some cases may be most economical.

Concrete or Cement Mortar—A thickness of from ½ to 3 in. can be used, depending upon conditions. Compared with other systems, it is of at least equal general efficiency and is usually the most economical. Under most conditions, a 1½-in. coat of good 1:3 cement mortar reinforced with poultry netting is efficient and economical. For the spandrel walls of filled arches a plaster coat of ½ in. thickness will suffice in many cases.

In considering the protection or armor course, it should

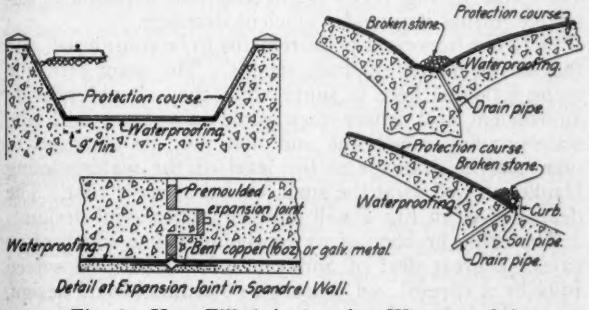


Fig. 2. How Filled Arches Are Waterproofed

be constantly kept in mind that it does not form a true drainage surface and that its sole function is to protect the waterproofing from injury.

The provision of proper drainage is most important. The various designs will suggest the important details and application. However, two or three general requirements have been stated, about as follows: "One per cent grade to the drainage surface is the minimum desirable and grades away from points difficult to waterproof should be correspondingly increased. Pockets difficult to drain and the features which might induce capillary action are to be avoided. Where possible, edges of flashings, joints, etc., should be located above the highest probable water level." One underlying principle should be constantly kept in mind. The membrane is the waterproof drainage surface and provision for run-off from it should be provided. Failure to do this simply builds a pond on the waterproofing blanket. With these various points in mind, attention may be turned to a detailed consideration of structure types.

FILLED CONCRETE ARCHES

On filled concrete arches there are two points of danger, namely, at the juncture of the spandrel walls and the arch barrel, where settling of the arch ring often creates cracking, and at the expansion joints in the spandrel walls. The first can be taken care of by waterproofing the spandrels with separate sheets carried vertically and lapping well out on the barrel of the arch. For the second, the detail suggested in the cross section in Fig. 2 has proven successful. The form of vertical expansion joint can be effectively used on retaining wall and similar construction. A suitable cap flashing under the coping to prevent vertical seepage should be provided and should lap at least six inches over the vertical joint.

Drainage for this type is generally provided between the springing lines on the piers or on and through the abutments. Water should not be allowed to pond in the abutments, as it is apt to cause heaving from frost.

In filled highway arches, where the pavement rests directly on the fill, it may be necessary, under certain conditions, to stop the waterproofing at about the pavement level. The design indicated in Fig. 3 (a) has proved efficient for this.

SLAB DECK, HIGHWAY OR RAILROAD BRIDGES

For deck slabs the waterproofing is carried over the entire deck area, unless the sidewalks are cantilevered, in which case they are usually not waterproofed. It is felt, however, that where possible the waterproofing sheath should cover the entire flat area.

There are two points of danger in the waterproofing of such structures:—the flashings and expansion joints. Where possible, the flashing should extend above the possible water level and drain on to a flat surface. In many cases, however, it must be stopped at the curb line and for this flashing there are two designs which have proved successful.

The other flashing detail is the same save that the copper cap flashing strip is omitted. This decreases the efficiency to some extent, but the adhesiveness of expansion joint cement and its ductility at all temperatures allows sufficient results. On railroad structures, where flashing against a vertical surface must be made, efficient results will be obtained by a generous groove formed in the protection course, so as to expose the upper edges of the flashing, and this groove filled with expansion joint cement.

In handling flashing details it should always be kept in

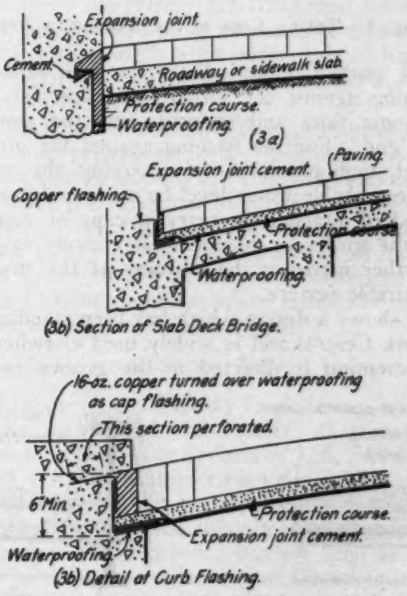


Fig. 3. Waterproofing Highway Slabs

mind that the groove should expose the edges of the flashing or membrane and that the filler for this groove should be a special asphaltic cement of great adhesiveness and ductility at all temperatures. All flashing should be done with separate sheets.

Expansion joints are particular causes of difficulty and annoying leakage. It can be definitely stated, however, that with the exercise of proper care efficient results can be obtained. It may be said, as a basic principle, that to obtain such a joint the membrane must be carried over the joint without a break and that suitable provision must be made to avoid strain on this section of the membrane. Drainage should always be away from expansion joints unless a "diked" joint is used and proper

provision for the prevention of pressure on the joint material and for maintaining pavement should be made. Fig. 4 takes into account all of these requirements and offers a solution to the problem.

THROUGH-GIRDER BRIDGES

On steel railroad structures, through-girder bridges are the only ones which impose different types of problems. The deck girder and the steel trough construction details are essentially the same as for slab deck structures or as for the through-girder type. There are three

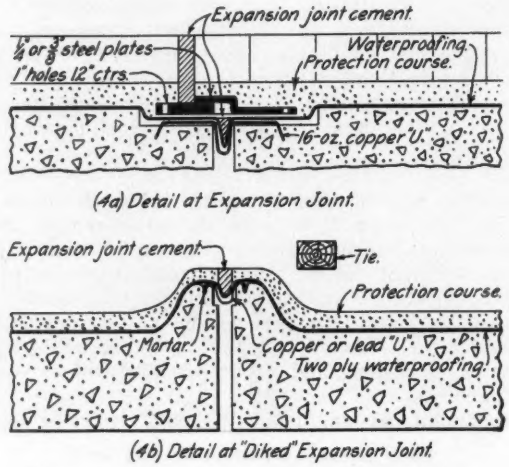
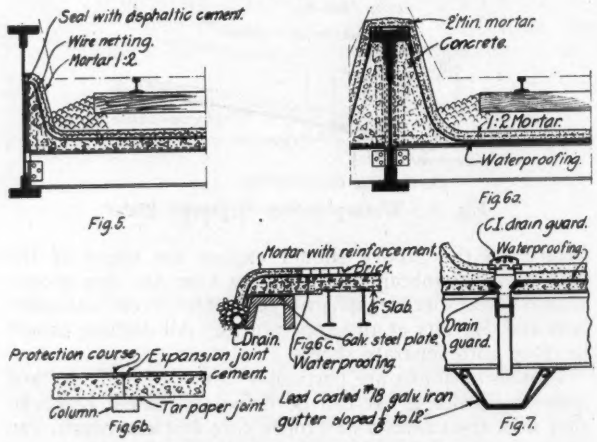


Fig. 4. Taking Care of the Expansion Joints

points of particular importance on such structures:—the flashing against the girder, provision for cracking over column lines and waterproofing the abutment at the free end. For the flashing against the girder it is important that provision for carrying the membrane above the probable water level be made and it is becoming standard practice to carry a cant of concrete up against the girder or to encase it entirely in concrete. This further increases the stiffness of the structure—a most desirable feature.

Fig. 5 shows a design which has been standard on the New York Central and is widely used elsewhere. Particular attention is directed to the groove against the



Some Special Waterproofing Details

girder and the filling of expansion joint cement. It is believed that this system is superior in efficiency to flashing angles and similar design and it is certainly very much more economical.

Where a structure carries multiple tracks, the method shown in Fig. 6 (a) for handling the waterproofing over the center girders is effective. Where all girders are to be encased solidly this same design can be used for the outer girders.

Over the column lines, where reverse bending moment occurs, cracking seems inevitable. The detail in Fig. 6 (b) provides for this efficiently and is strongly recommended. One variation for this, which is sometimes recommended, is to substitute for the groove simply a fold in the waterproofing membrane resting on the flat surface. This allows an excess of materials at the point of movement and has proven efficient.

At both abutments waterproofing should, where possible, be carried below the bridge seat and at the free end a fold should be made between the slab and the abutment so that the waterproofing blanket will not be torn. The detail in Fig. 6 (c) is effective and particularly desirable in that it provides efficient drainage.

Only one important point remains to be considered, and that is the matter of drain details. The main principle to be followed here is simply that they should provide an efficient seal where they come in contact with the waterproofing membrane and that they be arranged to take care of drainage at the level of the waterproofing blanket as well as at the surface of the armor coat. The details given in Fig. 7 will indicate a successful design.

The entire problem of waterproofing is one which often causes a great deal of annoyance, but it can be solved fully by a careful and thorough co-ordination of design, materials and workmanship and a constant attention to detail.

SUDDEN RAVINGS

'WAY BACK there when gasoline "speeders" were considered a luxury instead of a necessity, the Czar on the Ring Tail division of the Monkey Central purchased a nice green specimen—"so he could get about his 'deestrict' and *talk* to his section foreman." It came into the division headquarters by freight (d. h.). He uncrated the "b-r-r-rute," assembled it, "iled" it up, read the instruction book as how to run it and went *"plut-plut-plutting"* down the track, making a noise like a machine gun. In his hurry to get started, however, he failed to read all about *how* to STOP it.

When he reached the first section foreman, he raced past, frantically pulling on the brake lever. "Frank," he called out, "I want to see yeeze whin I kin git this dom thing stopped."

A half a mile or so down the track the brake choked the engine. He turned around and speeded back. As he passed the gang a second time he sputtered out: "Frank, I have something important to *tell* yeeze."

Within a mile he again got "stopped" and headed the other way. Acceleration increased regardless of what he pulled or twisted on the deck of the car. Again he passed the gang at 35 m.p.h. "Frank," he yelled, "I'll *write* yeeze."

* * *

Speaking of section men, the following dialogue took place between the respective foremen of two trunk railroads:

Pat: "I haz only two min and a Swede and I have to put in a rail. How many min haz yeeze, Jerry?"

Jerry: "Siven."

Pat: "Kin yeeze let half of thim come over and gimme a hand?"

Jerry: "Shore, Pat."

The question *is:* How many men did it take to change rails?

Most Roads Favor the Use of Spirals

Very Large Proportion of All Curves on Main Line Tracks Are Now Provided With Easements

While the easement curve as a factor in good riding track is a matter of vital importance to the man in charge of track maintenance, it must be conceded that the subject has received little attention of late outside the regular routine of the office and field. It is not so many years since maintenance of way men were wont to argue this subject at every opportunity because a great many were either opposed to the use of the spiral in any form or were satisfied with such tapers as the section foreman could introduce "with his eye." An estimate made in 1895 indicated that only about 25 per cent of the railroad curvature of the country had been provided with easements at that time.

This condition has since been changed and in recent years the transition curve has come to be quite generally accepted as a necessary feature of railway alinement. Information obtained from a considerable number of representative railroads shows that the use of the transition, easement, spiral or taper curves as they are variously called, is now almost universal for main line railways. This and other pertinent facts concerning easement curves were developed with the aid of a questionnaire addressed to the chief engineers of 42 railroads in this country and in Canada with a view to ascertaining what the present practice is. The interest which this subject aroused is indicated by the fact that replies were received from 39 of them. The questionnaire was as follows:

Questionnaire Regarding the Use of Easement Curves

To what extent do you employ easement curves?

What type of easement curve do you employ?

Do you use easement curves for all degrees of curve, or do you restrict their use to curves of a certain degree or sharper, and if so, what degree?

Is the length of easement curve based upon the train speed as well as the degree of curve, and if so, how?

Is the easement curve established by your engineer corps or by the supervisors?

Is the use of the offset method or the method by deflections given preference?

Do you employ the string method of establishing easement curves in existing tracks?

Are the limiting points of the easement curves defined on the ground by permanent markers and do these carry the data as to full elevation and rate of run-off?

Are easements introduced at the time a new line is constructed or subsequently?

The replies have been tabulated in the large chart in as near the form in which they were received as was possible. Practice as regards matters of this kind is not subject to abrupt modification. Consequently, we find that the replies received from three officers of the Canadian National reflect the individual practices of the several lines absorbed in this system. Similarily, it has been found desirable to tabulate the replies received from the four regions of the Pennsylvania system so as to show the practices as they have prevailed on the lines east and west of Pittsburgh.

Nearly All Roads Provide Easements

By far the most pertinent fact disclosed by this chart is that all the roads reporting except one, the Chicago & North Western, make some use of transition curves. On one other road the use is characterized as "limited," this being the Pere Marquette, a road with a relatively high proportion of light traffic branch lines. The extent of the use of spirals, as reported by the 38 lines which use them, is somewhat varied, but in general it may be said that they are used on main-line, high-speed tracks in nearly all cases. The classification of these lines as tabulated is as follows: On all lines, 4; on practically all lines, 9; on main lines and important branches, 2; on main lines, 7; on high speed tracks, 6; "limited use," 1; replies indefinite, 9.

Practice Varies

Another field for variation in usage relates to the minimum degree of curvature for which it is deemed necessary to provide easements. The replies to this question are classified as follows: On all curves of 1 deg. or over, 11; curves of 1 deg. 30 min. or over, 1; curves of 1 deg. 45 min. or over, 1; curves of 2 deg. or over, 11. The replies received from six roads indicated a more elaborate classification. Thus, the Canadian Pacific spirals all curves of 2 deg. or over on main lines, but only curves of 4 deg. and over on branch lines. On lines of the Pennsylvania System west of Pittsburgh, all curves of 2 deg. or over are spiraled, but on lines carrying trains at speeds in excess of 40 miles per hour, the minimum limit of curvature is reduced to 0 deg. 45 min. Obviously, the faster the speed the greater the refinement necessary in easements. However, a study of the table does not show that the roads handling a larger proportion of high speed traffic are given to providing spirals for flatter curves than roads with slower trains.

The spiral dates back to early days in railway building. Rankine made references to it. Wellington developed some simple approximations. In 1880 the Holbrook spiral was first made public and in 1882 Searles published the first edition of his "Railroad Spiral"—"to reduce the well-known theory of the cubic parabola or multiform compound curve to a practical and convenient form." Since then a multitude of variations have been developed and put to use on the different roads.

A. R. E. A. Spiral Little Used

In 1911 the American Railway Engineering Association adopted for inclusion in its manual of recommended practice an easement curve devised by J. B. Jenkins, valuation engineer of the Baltimore & Ohio, which is known as the 10-chord spiral, but from the results of this investigation it would appear that this effort of the association to effect uniformity of practice has not been as successful as has been the case with some of the other standards published in the manual. Only two roads report the use of this particular form of spiral; of the other replies, 11 name the Talbot spiral; eight favor the Searles transition curve, and 11 use the rather general term "cubic parabola." Three replies do not indicate a preference for any particular type of curve, while the others report a variety of easement, so that, in all, curves with 12 different names are mentioned.

This variety may be explained in part by the fact that the true cubic parabola is a matter of intricate mathematics, approximations of which are to be had in a variety that affords a most fertile field of operation for the mathematician. Without doubt the 10-chord spiral of the American Railway Engineering Association has not received as wide a use as is warranted by the merits of this particular form of transition curve. Failure to apply it

must, therefore, be ascribed to other causes. For instance, it may be suggested that the presentation of this transition curve in the manual is not as attractive nor in as detailed a form as the characteristic expositions of easement curves commonly appearing in the handbooks of field engineering.

SPIRALS INSERTED BY ENGINEERS

As the railroad taper is of necessity a matter of more or less intricate mathematics, it is not surprising that the replies from all roads favor the employment of engineers for the application of the tapers to the alinement. In noting that the answer of the Pennsylvania System, eastern lines, contains the word "supervisors," it should be recalled that on that road the supervisor is an engineer in nearly all cases. In the same connection it is of interest to note that under Method of Application, 28 of the roads favor the method of deflections, four the method of offsets, two express no preference, while four give indefinite replies. On this point, William Hood, chief engineer of the Southern Pacific, states that careful work by the offset method requires more time than the deflection method.

The question as to the use of the string method of lining spiral curves received only one unqualified affirmative reply and that from the Pennsylvania System, eastern lines. This method is not used at all on 25 roads, it is used only occasionally on five and it has supplemental or emergency use on four. Since the replies to the questionnaire were in nearly all cases received from the chief engineers of the railroads, it is entirely possible that "unofficial" use of the string method may be more extensive than these replies would indicate.

LENGTH OF SPIRALS

Another important matter in the discussion of spirals is the determination of the length, which involves a number of considerations, among which the most important is the distance required for an easy runoff of the superelevation. On new location in easy country there is no limit on the length to which the easements may be extended. In difficult country a long spiral introduces complications as will be explained later. There are also limitations on the lengths of spirals when they are being introduced on old lines, since long spirals increase the difficulty of fitting the curve to the old roadbed.

Broadly speaking, this problem involves the inter-relation of curvature, speed and superelevation which are not properly a part of this discussion. Consequently, the question concerning this matter in the questionnaire was stated simply as: "Is the length of the easement curve based upon the train speed as well as the degree of curve and if so, how?" Answers to this question showed that 25 railroads consider speed as well as degree of curve, while 9 determine the length of the easement from the curvature alone. Five replies were indefinite as to this question or reported varying practices. On three roads the length of the spiral is determined directly from the speed and curvature through the formula $L = K\ V\ E$, where L is the length of the spiral curve in feet, K is a constant, V is the velocity of the train in miles per hour and E is the superelevation of the curve in inches. The constant K was given in two cases as 1.0 and in one case as $1\frac{1}{3}$.

On a number of roads the length of the spiral is made directly proportional to the elevation of the circular curve, the rules to this end calling for 40 ft. to 66 ft. of transition curve to each inch of superelevation. For convenience these rules are commonly expressed as ½ in. or ⅝ in. for each 30 or 33 ft. rail length.

That the length of the spiral has an important bearing on railway location in difficult country is brought out very emphatically in a statement by Mr. Hood of the Southern Pacific which accompanied his reply to the questionnaire. This is as follows:

LENGTH OF SPIRAL IN DIFFICULT COUNTRY

"The usefulness of the taper depends on the general maximum running speed of the trains in the several localities, and where speed restrictions result in slow speeds, as for instance, either up or down steep mountain grades, the taper is not needed to a very great extent, and in such localities a very short taper is justifiable if its use will result in an appreciable saving over the cost of construction required by a longer taper.

"It is evident that when a train is once on the main curve, the taper has no further effect and it is no more appropriate to run too fast, for instance, on a tapered eight-degree curve than on an eight-degree curve that is not tapered. On valley lines, a taper beginning with 30 ft. of a 15-min. curve provides adequate easement for the use of the fastest trains. On a mountain side and similar lines with steep grades and moderate grades, a taper beginning with a 2-deg. 30-min. curve is found to give excellent results, and its use is entirely justified where a flatter (and longer) taper would involve increased cost of construction.

"Too flat a taper and too long a reversing tangent increases the cost of construction in a mountain country with steep transverse slopes, or in a confined river gorge where flood water is dangerous and the mountain sides are steep, to an extent not always fully appreciated. The effect of the taper and reversing tangent in increasing the cost of construction is indicated by the amount that the resulting distance, in a direct line between the centers of the corresponding main curves, is in excess of the sum of the main curve radii, the difference of these distances indicating the additional horizontal distance to be disposed of in excess of that involved in the case of reversed curves without tapers and without reversing tangents between them.

"The greatest effect of this sort results from the use of flatter tapers, indicating that more benefit is to be derived with the same expenditure in construction from the use of longer reversing tangents than from the flatter tapers. A reversing tangent 180-ft. long provides amply for the longest engine and tender now in use, including a suitable length at each end of the reversing tangent for handling the elevation of the track for the first 30 ft. of the taper curve.

"To illustrate this, take the case of two six-degree curves with tapers commencing with 30 ft. of one-degree curve and with 120 ft. of reversing tangent. These curves will have their centers separated by a distance of 21.7 ft. greater than the sum of their radii. Two six-degree curves with tapers commencing with 30 ft. of 30-min. curve and with 120 ft. of reversing tangent will have their centers separated by a distance of 63.1 ft. in excess of the sum of their radii. Thus in the latter case it is necessary to dispose of an additional horizontal distance of 41.4 ft. in excess of that in the first case and this 41.4 ft. might result in prohibitive or at least in extravagant cost of construction. This indicates the need of conservatism in deciding on the financially appropriate taper curve rate."

SPIRALS ARE INSERTED DURING CONSTRUCTION

It is clear from the replies received that the use of spirals has extended over a considerable period of years and that since their adoption the easements are being applied to the alinement at the time of construction in nearly all cases. The work of applying the easement to the lines built previous to the adoption of the easement curve

has, of course, been carried out as opportunity afforded or as the increase in the traffic or the importance of the line demanded. Thus, the Canadian Northern reports that these easements are being introduced on old lines at times of reballasting, while other roads report that this is done during extensive reconstruction work. The replies with regard to this feature of the questionnaire are summarized as follows: On 32 roads the spirals are introduced at the time of reconstruction; on three they are applied subsequently; on one road they are introduced at the time that the track is laid and being lined; on another they are laid out just before ballasting. One road reports a varied practice.

No discussion of easement curves is complete without

SUMMARY OF PRACTICE WITH RESPECT TO EASEMENT CURVES

Road	On What Lines	On What Curves	Type of Easement	Length Determined by	Laid Out By Whom	Offsets or Deflections	Is String Method Used?	Use of Markers With Curve Data	When are Easements Introduced
A.C.L.	-	2°+	Talbot	elevation	engr.	defl.	no	no	construction
B. & O.	main lines major br.	1°+	Talbot	elevation	engr.	defl.	for checking	yes	construction
B. & M.	generally	all	Cub.Par.	degree of curve	engr.	defl.	no	no	-
Can.Nat.East	wherever possible	1°+	Holbrook	degree of curve	engr.	defl.	no	no	construction
Can.Nat.East	-	1°+	four types	practice varied	engr.	defl.	no	no	construction
Can.Nat.West	practically all	2°+	Holbrook	degree of curve	engr.	defl. preferred	very seldom	when reballasting	construction
C.P.R.	-	2°+ (main) 4°+ (br.)	Parabolic	elevation	engr.	defl.	no	yes	new lines
C. & A.	all main lines	2°+	Searles	50' per in. elevation	engr.	defl.	no	stakes	construction
C. & E.I.	for speed of 30 m.p.hr.	1°+to 2°+ dep.on speed	Crandall	60' per 1" elev.	engr.	defl.	no	without data	-
C. & H.W.	not used	-	-	-	-	-	-	-	-
C.B. & Q.	all new lines old where prac.	1°+ and 2°+	A.R.E.A.	½" to ¾" per 33' rail	engr.	defl.	optional	without data	construction
C.G.W.	all lines	1°+	Cub.Par.	for 30 m.p.hr.	engr.	offset	no	without data	construction
C.M. & St.P.	main lines	1°+	Talbot Searles	L = V E	engr.	-	no	no	construction
C.R.I. & P.	all new lines realignment	2°+	Berry	speed	engr.	defl.	no	yes	construction
C.C.C. & St.L.	-	1°+	various	speed curvature	engr.	defl.	no	yes	construction ballasting
D.L. & W.	all main lines	2°+	Talbot Searles	speed and judgment	engr.	defl.	for checking	stakes	construction
D. & R.G.	nearly all lines	2°+	Searles	½" per rail	engr.	defl.	no	stakes	construction
Erie	all construc. & reconstruc.	1°+	Talbot	degree of curve	engr.	defl.	not.gen.	without data	construction or reconstru.
G.N.	all main lines	2°+	Cub.Par. Talbot	speed	engr.	offset	limited	yes	construction reballasting
I.C.	-	2°+	No standard	elevation	engr.	both	no	no	construction
L.V.	all curves	all curves	A.R.E.A.	elevation	engr.	defl.	emergent	no	construction
L. & N.	all main lines	1°+	Searles	40' to 66' per in.	engr.	defl.	for checking	without data	construction
M.C.	where speed over 40 m.p.hr.	all curves	Talbot	elevation	engr.	defl.	no	without data	construction
M.St.P. & S.S.M.	new lines and reconstruction	2°+ 1° 30'+(spl)	Searles	degree of curve	engr.	defl.	no	no	construction
M.P.	all but minor branches	1° 45'+	Talbot	degree of curve	engr.	defl.	exceptional cases	yes	construction
N.Y.C. east	almost all lines	1°+	Cub.Par.	degree of curve	engr.	defl.	no	without data	construction
N.Y.C. west	all lines	0° 30'+ main 1°+ branches	Cub.Par.	usual 200'	engr.	offset	no	without data	construction
N.Y.,N.H. & H.	high speed lines	1°+	Stephens 6 chord	L = VE	engr.	defl.	no	without data	construction
N. & W.	generally since 1906	2°+	Wentworth Searles	Searles & Wentworth	engr.	-	no	yes	construction
N.P.	generally	-	Searles	L = ½VE	-	-	-	yes	construction
Penna.East	all high speed	not restricted	No standard	33' per ½" elev.	supvr.	offset	yes	no	when track is laid
Penna.West	all lines	all 2°+ (over 40m.p.h.) 0° 45'+	Crandall	60' per 1" elev.	engr.	defl.	no	yes	construction
P.M.	limited use	2°+	Talbot	-	engr.	defl.	-	yes	subsequently
P. & R.	main high speed	1°+	Cub.Par.	on elev.	engr.	both	no	without data	construction
St.L.-S.F.	class A	all	Talbot	60' per 1" elev.	engr.	defl.	no	yes	construction
Southern	main line	all	Sullivan	degree of curve	engr.	defl.	no	yes	after completion
S.P.	all new lines great part old	1° 30'+	Hood	judgment	engr.	defl.	no	without data	construction
U.P.	-	-	-	30' or 33' per ½"to¾"	engr.	-	-	no	construction
Wabash	on major lines	2°+	-	degree of curve	engr.	defl.	no	no	subsequently

some consideration of the means provided for a permanent record of the spiral locations and of the information supplied to track forces for maintaining the alinement and superelevation. It was for this reason that the questionnaire included the question "Are the limiting points of the easement curve defined on the ground by permanent markers and does each carry the data as to the full elevation and rate of run-off?" To this question 12 roads replied that such permanent markers were provided with complete data; 11 stated that markers were provided without any data; 3 reported the use of stakes; while 10 roads replied that no markers were provided; one road reported a variable practice, while another stated that the location of the spirals was carefully referenced.

A Modern Air Lift Pumping Plant

BY JOHN OLIPHANT,
Chief Engineer, Pneumatic Pumping Department, Sullivan Machinery Company, Chicago

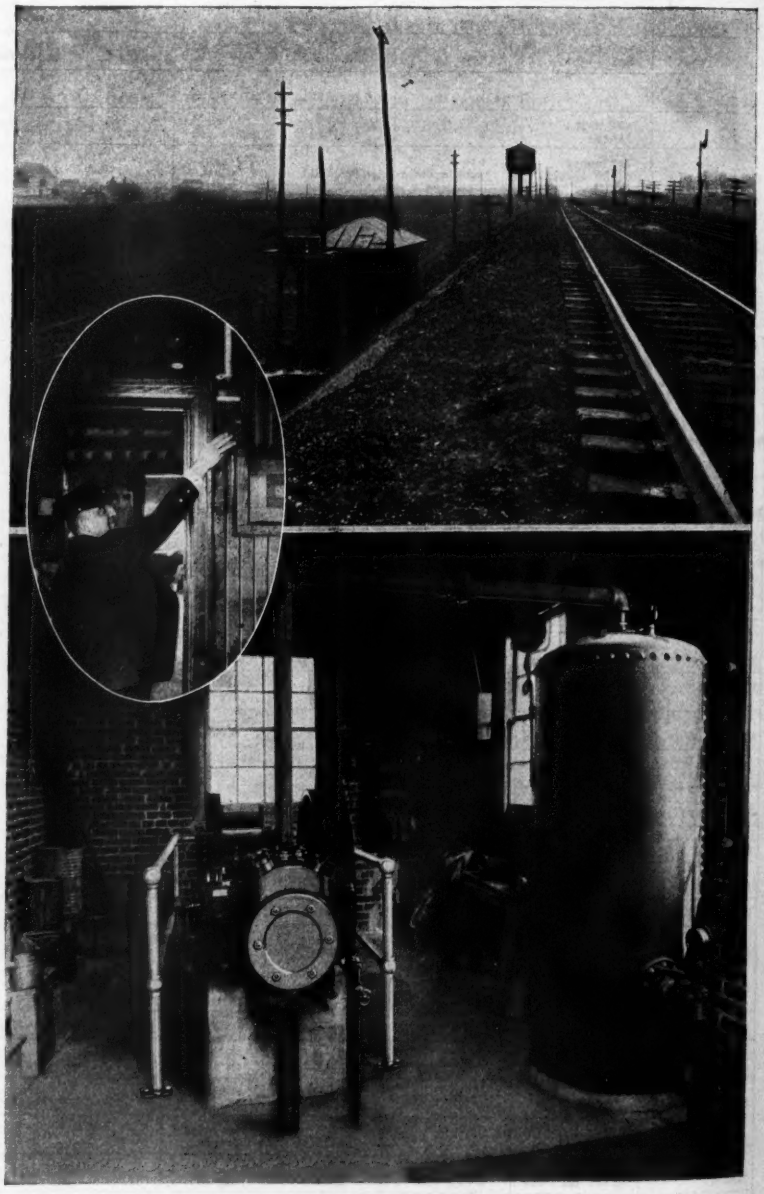
DURING 1919-1920 an air lift pumping plant was installed by the Philadelphia & Reading at Telford, Pa., which embodies several distinctive features with regard to operation and regulation of this method of pumping. The problem was to deliver the water from an artesian well into an elevated tank located at a distance from the well, and to control the operation as to starting and stopping from another distant point; and at the same time control the cooling water supplied to the water-jacketed air cylinder of the compressor.

The work to be done was to pump approximately 100 gal. per min. from a 10-in. well, 350 ft. The casing is 6 in. in diameter; the static head 13 ft.; the drop 51 ft. through 536 ft. of 4-in. pipe, with a rise of 14 ft. to the base of the elevated tank and the elevation into the tank, about 66 ft.

The well was equipped, as shown in the drawing, with a Sullivan 3-in. air lift foot piece, having outside air connections and with a multiple orifice mixing tube located centrally in the mixing chamber, discharging the air through a number of small openings into a relatively thin sheet of ascending water. This design secures a complete emulsion of the air and water in the foot piece, which was suspended in the well by means of a 3-in. eduction pipe and a 1½-in. air line to the well-head flanges. A regulating air valve was installed in the 1-in. air line near the well head to regulate the flow of air to the foot piece.

In the pit around the well head and connected to the eduction pipe was located a Sullivan cyclone booster, 30 in. in diameter by 30 in. high. The combined air and water was discharged into this booster or separator near the top and at one side at a tangent to the periphery under high velocity from the well, causing it to swirl and thus effect a perfect separation of the air and water. The water leaves the separator at the bottom, also at a tangent to the periphery and the air passes off at the top. The downward centrifugal action completely separates the air from the water before it passes out.

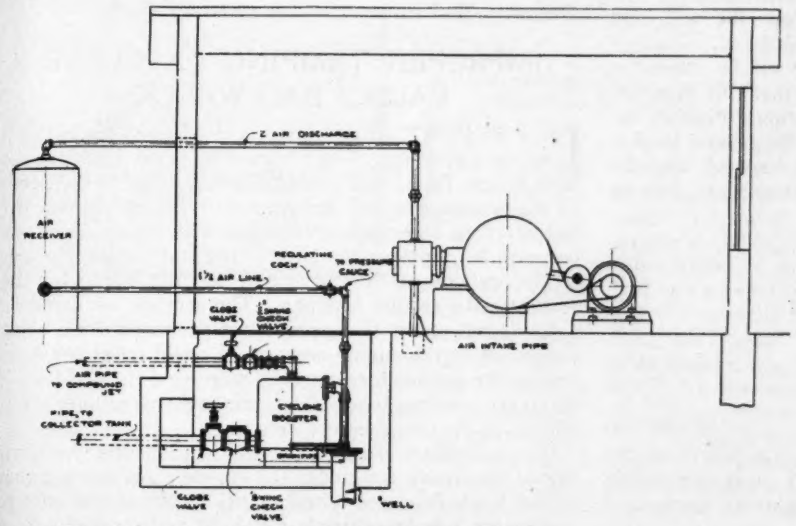
The air pressure in the booster was controlled by a valve set to maintain the pressure required by the head against which the booster was discharging, this head be-



The Telford Plant
Above—The Pump House and the Tank. Below—Interior View of the Plant. In the Oval—Agent Pushing the Button.

ing caused by the friction in the 536 ft. of horizontal run, a rise of 14 ft. from the booster to the base of the elevated tank, and the elevation of 66 ft.

An air line was installed, connecting the vent of the booster to a mixing tube or compound jet in the base of the riser so that the air which had been used to lift the water to the surface was further utilized to lighten the head in the riser, the air and water being finally discharged under an umbrella separator, located in a small collector tank at the top of the large tank.



The Compressor, the Air Receiver and the Well

A photograph illustrates the compressor installation at the well. A Sullivan 9 by 8 single-stage compressor is operated by a 20 hp. General Electric squirrel cage induction motor, by a short center belt drive and an endless 6½-in. double leather belt.

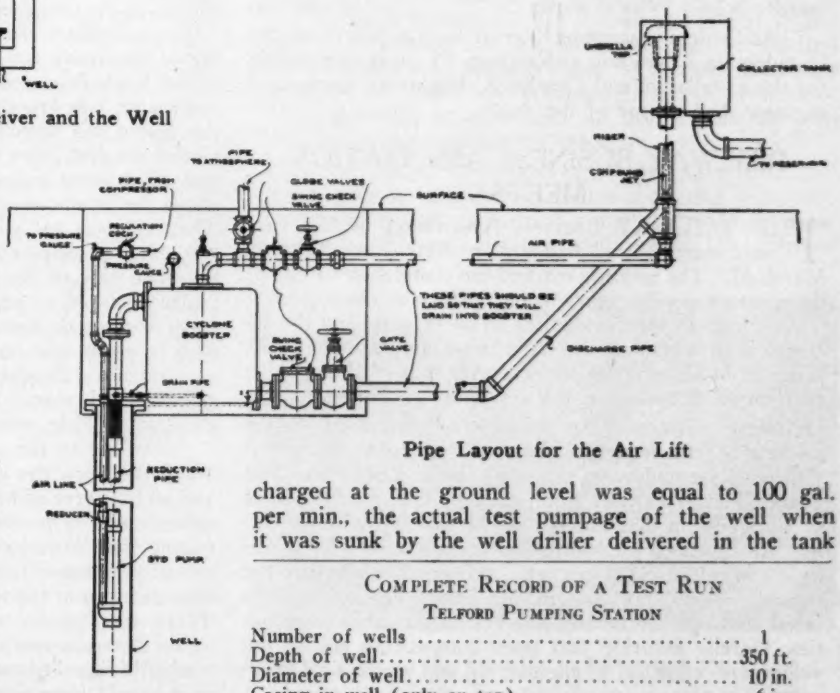
REGULATION

As it was required to control this plant from a distant point, it became necessary to unload the compressor when it stopped, and in starting, to permit the compressor to get up to speed before the load was thrown on. This was accomplished by means of a flyball governor on the compressor that acted as an unloader when it was at rest, and did not admit air to the compressor until the speed had elevated or extended the controlling balls. It was also necessary to shut off the cooling water to the air cylinder when the compressor was stopped, and turn it on again when started. This was accomplished by placing a balanced solenoid valve of the normally closed type in the cooling water line controlled from the starting control at the switchboard.

A push button, together with a relay, were located at the pumping station. In the railway station, 3,600 ft. from the plant, another push button was installed and an electric connected pressure gage at the base of the elevated tank was connected to a bell at this latter point to give the alarm when the tank was full of water. Provision was then made for starting and stopping the plant either at the pumping station or at the station 3,600 ft. away. As the compressor is of the enclosed, splash lubrication type, and is equipped with a McCord force-feed lubricator, it is safely manipulated from the station, where a push of the button by the station agent starts the pumping and when notified by the ringing of the bell that the tank is full another push stops it. The air and water lines were laid so as to drain back into the booster, and a small connection with a partially opened valve was made from the bottom of the booster back into the well, so that all connections drain to obviate freezing in cold weather during idle periods.

The air lift, in connection with the booster and compound jet, is particularly adapted for this work, as the water does not come in contact with a valve or any moving part from the time it starts until it is discharged into the tank.

A report is given below of the test run made on December 28, 1920, and from this statement it will be noted that while the amount of water discharged at the ground level was equal to 100 gal. per min., the actual test pumpage of the well when it was sunk by the well driller delivered in the tank



Pipe Layout for the Air Lift

COMPLETE RECORD OF A TEST RUN

TELFORD PUMPING STATION

Number of wells	1
Depth of well	350 ft.
Diameter of well	10 in.
Casing in well (only on top)	6 in.
Static level of water below surface	13 in.
Elevation to which water is to be delivered above ground level	66 ft. 4 in.
Horizontal distance to point of elevation	536½ ft.
Size of delivery pipe	3 in.
Size of air pipe	1½ in.
Length of 3-in. pipe in well	303 ft. 9 in.
Length of air pipe in well	304 ft.
Length of foot piece	26 in.
Amount of air pressure required to remove static head	120 lb.
Amount of air pressure required to operate	102 lb.
Amount of air pressure required to operate booster	21 lb.
Amount of water per minute discharged at ground level	100 gal.
Amount of water discharged per minute in tank	94 gal.
Capacity of tank	75,000 gal.
Capacity of mud drum under tank	1,980 gal.
Time required to fill tank with water	13 hr. 35 min.
Speed of motor driving air compressor with load	1,216 r. p. m.
Speed of air compressor	205 r. p. m.

Power required when pumping	12½ hp.
Current consumption registered during run of 13 hr. 35 min.	200 kw. hr.
Duration of time between starting compressor and delivery of water in water tank	6 min.

was only 94 gal. per min. The difference in quantity can be attributed partly to the fact that the pumping outfit was ordered on a basis of 450 ft. of pipe line between the well and the tank; whereas, the actual measurement of this pipe line, measured horizontally between the well and the point of entrance to the tank is 536½ ft.

The actual total distance of pipe line will be somewhat more than this on account of the fact that this pipe line is laid on a slope of about 14 ft. elevation difference between the ground level at the tank and the ground level at the well, the pipe line rising between the well and the tank. From the test the following figures as to duty of the plant may be developed:

Static head	13 ft.
Drop	51 ft.
Elevation tank	66 ft.
Elevation pipe	14 ft.
Pipe friction	5 ft.
Total head	149 ft.
Theoretical power required	3.55 hp.
Actual electrical input	12½ hp.
Overall efficiency (wire to water)	28½ per cent

J. A. Seiders, superintendent of motive power of the Philadelphia & Reading at Reading, Pa., was responsible for the installation and Charles A. Bingamin, mechanical engineer, had charge of the work.

RAILWAY BUSINESS ASSOCIATION MEETS

THE RAILWAY Business Association held its annual meeting and banquet in New York City on March 31. The meeting marked the completion of one of the most successful years in the history of the organization both from the standpoints of work done and the increase in membership, the latter, now approximately 700, being an increase of 88 per cent over that of 1919. Alba B. Johnson, president of the association, presided.

Among matters of special interest discussed at the meeting was a report of the Committee on Equipment Policies presented by its chairman, E. B. Leigh, president of the Chicago Railway Equipment Company, in the form of a suggestion that the association take up with the Interstate Commerce Commission the question of its attitude toward new devices, etc., and inquire whether the commission did not contemplate permitting railroads to select and operate devices subject only to their capabilities, thereby assuring that open competition among developers so essential to engineering and mechanical progress.

Another report, presented by D. P. Bush, president of the Buckeye Steel Castings Company, was in the form of a communication to Herbert Hoover, Secretary of Commerce, on the Stability of Railway Purchases, in which attention was called to the value of stabilizing railway purchases as a means of avoiding business depressions and requesting a conference to discuss certain phases of the subject.

The banquet was addressed by Daniel Willard, president of the Baltimore & Ohio, and chairman of the American Railway Association, and by Edgar E. Clark, chairman of the Interstate Commerce Commission. Mr. Willard in his address on the Three Epochs of American History, expressed himself to the effect that the success of private ownership is assured if the present open-minded attitude of the Interstate Commerce Commission continues and the railway managers do not lose sight of the fact the railroads must serve the public. In his address on The Problems of Management and Regulation, Mr. Clark referred among other things to the many appeals for reductions in transportation rates and stated that the Commission was extending itself fully to adjust the many inequalities existing, but that in the knowledge of the small margin between the present income and operating cost of the roads (about 8.7 cents on the dollar) it was difficult to find justification for general reductions.

IMPROPER TAMPING ON CURVE CAUSES BAD WRECK

IN A REPORT on the derailment of a passenger train on the Cincinnati, New Orleans & Texas Pacific, near New River, Tenn., on April 6, which resulted in the death of five passengers and the injury of 75, the Bureau of Safety of the Interstate Commerce Commission found the cause to be improper tamping of the track under the ties on the outside of the curve and laid the blame for the wreck on the section foreman. The accident occurred on a six-degree curve, the speed of the passenger train being estimated by the engine crew at 35 or 40 miles per hour and by the section foreman who witnessed the accident at about 60 miles per hour. The train had passed over about 195 ft. of the curve before derailing.

The immediate cause of the accident was the overturning of the inside rail under the engine. An examination of the track disclosed wheel marks inside of the outside rail on six ties preceding a rail joint and on the web of the inside rail directly opposite. The latter marks occurred six feet from the receiving end of the overturned rail, its leaving end being twisted outwardly. Nothing about the engine warranted its consideration as a cause. The track was laid with 85-lb. rail, with about 20 ties per rail. It was tie-planted, rock-ballasted, double-spiked on the gage side of the inside rail and its general maintenance declared to be good. However, the section crew were working on the curve at the time under the direction of a foreman who had been employed on the division as a foreman for 29 years and who was considered a capable, reliable track man. The gang was renewing ties and increasing a 3½-in. elevation about an inch.

According to the section foreman, at the time of the accident 43 new ties had been placed, tamped with shovels and all but three spiked, the unspiked ties alternating with spiked ones. The train had not been flagged, the foreman stating that he had considered the run-off from the new elevation to the old elevation sufficiently safe for the passage of trains at the regulation speed (30 miles per hour). There was considerable conflict between the testimony of the foreman and the engineman on the significance of a whistle signal given by the latter and whether the foreman should have given a proceed signal to the train.

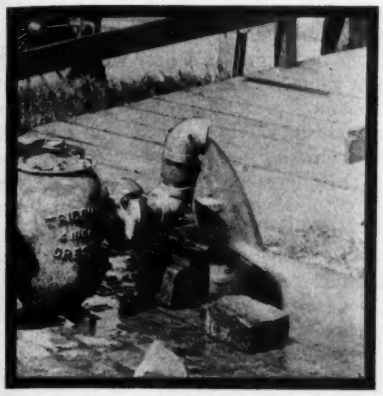
The foreman attributed the accident to expansion of the rails, testifying that upon beginning the work that day he had noticed indications of expansion from heat and had pulled the track as much as 3 or 3½ in. in the vicinity of the run-off prior to the accident. Other testimony indicated that the joints were not jammed together as tightly as they would have been under such conditions.

The roadmaster's testimony made it appear that in making the run-off prior to the passage of the train, the section foreman had tamped under the ties on the inside of the curve, but not on the outside, and that the thrust of the locomotive against the outside rail on the track which was swinging, resulted in its rolling back against the inside rail, thereby turning it over. This explanation corresponded with that of the supervisor and was adopted by the committee.

INCRUSTED PIPES CAUSE HEAVY LOSSES

Increased Capacities and Reduced Pumping Cost Obtained by Effective Cleaning of the Mains

BY C. R. KNOWLES,
Superintendent Water Service,
Illinois Central, Chicago



Before Cleaning—6.05 cu. ft. per min.

After Cleaning—29.9 cu. ft. per min.

IT IS ONLY too true that many of the pipe lines in service at railroad water stations are either too small to carry the water required economically or the interior of the pipe is incrusted to such an extent that the carrying capacity is greatly reduced and the cost of pumping correspondingly increased. It does not necessarily follow that every water main in service is incrusted, as mains have been found to be practically clean after many years of service, yet the fact remains that a great loss occurs through incrusted water mains.

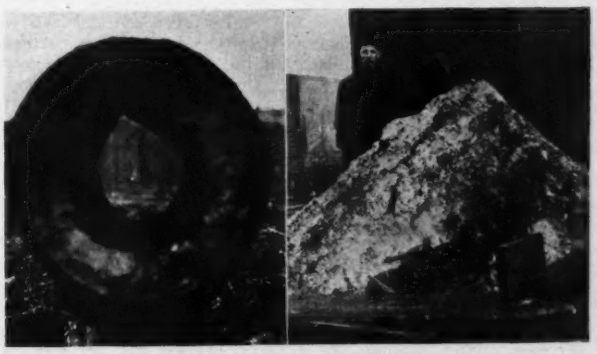
The loss in carrying capacity of dirty water mains is due to two causes, first, the reduction in area of pipe; second, the roughness of the interior surface. Of the two, the second is the most important and causes the greatest loss. For example, tests conducted on a 36-in. water main showed that the diameter of the pipe was reduced to about 34½ in., or an area loss of less than 10 per cent, while the carrying capacity was reduced about 45 per cent. Clemens Hershel found in his "115 Experiments" that the rivet heads in steel pipe might reduce the carrying capacity as much as 20 per cent. Therefore, it will be seen that the loss in carrying capacity cannot be figured from the reduction in area alone, but will depend also upon the roughness of the interior of the pipe.

SEVERAL CAUSES

The causes of dirty water mains may be divided into three general classes, incrustation, growths and deposits through sedimentation. Ordinarily, it is safe to say that the causes may be attributed to all three, but the trouble is primarily incrustation, sometimes followed by deposits or a growth of some kind. Deposition of material in suspension rarely occurs from moving water in a pipe line unless the interior of the pipe is roughened. There is, of course, some deposit when the water is not in motion, but this is not important except in rare cases and it usually occurs at low points on the line. A combination of all three of the causes of dirty water mains given above is not unusual and may occur through suspended matter being caught and deposited on the interior of the pipe as the incrustation forms.

Incrustation is the most serious condition encountered, as it is the most difficult to remove and apparently accumulates with more rapidity than either growth or deposition. According to D. G. Jackson in the Journal of the Society of Mechanical Industry, May 31, 1902, the growths or formations taking place can be classified under the heads of Crenothrix Kuhuiana, Crenothrix Manganifera and Crenothrix Ochracea and takes place where the water contains iron, manganese or aluminum. It follows that the prevention of these growths necessitates a water supply in which these metals are not present. One authority fixes the allowable limit of iron in water at 0.5 of one part in one million. Another authority states that 0.5 of one part in one million would not necessarily mean that there would be no Crenothrix formation. Dr. Brown states that acidity other than carbonic acid is necessary to other growth and that alkaline waters prevent them. A thorough filtration of water will retard and prevent Crenothrix growths to an extent, while in some cases the use of lime has been found to successfully combat them.

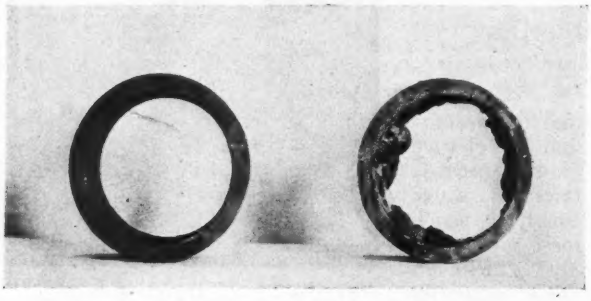
In addition to Crenothrix growths, pipe moss and sponge must be considered. These are living organisms and are dependent upon organic matter carried in water for foods. Hence, filtration will prevent the further growth of pipe moss and sponge by removal of the matter which forms their food. Deposits are the results of suspended matter carried in the water and usually take place at low points in the line or the points where the flow is not sufficient to keep the matter in suspension.



A 12-in. Main on the Big Four at Springfield, Ohio, and the Amount of Material Removed From a Length of 225 ft.

In a paper read before the American Water Works Association by Burt B. Hodgman in 1911 he presented a list of 29 dirty mains which had been cleaned mechanically, giving in each case the nature of stoppage. Twenty-one cases were iron corrosion, five cases from iron corrosion in combination with mud, pipe sponge and slime, one from lime deposit, one of clay mud scale and one of mud alone. This supports the popular theory that iron corrosion is chiefly responsible for the stoppage of water mains carrying water not subjected to chemical treatment.

The first record of cleaning of water mains on the Illinois Central was in 1867, when a line of 4-in. pipe, approximately 10,000 ft. long, laid at Centralia, Ill., in 1855, was cleaned. The pressure on this line increased greatly, due to incrustation, and it became inadequate to supply all the water required in 1867. Upon examination it was found heavily incrusted with what was termed a



Measurements of this 6-in. Main Showed an Average Reduction of Area of Only 15 Per Cent as a Consequence of Incrustation. However, the Loss in Carrying Capacity Was 55 Per Cent

clay-mud scale and it was taken up and cleaned and part of the line relaid with clean-out boxes placed 100 ft. apart. This provided only a temporary relief and a couple of years later the pipe was taken up and relaid with 8-in. pipe.

RESULTS SECURED

The chief trouble with dirty mains on the Illinois Central occurs in Southern Illinois. The results of cleaning 4-in., 6-in. and 8-in. mains in this territory is given as follows:

Carbondale

First cleaned in September, 1909; 11,547 ft. of 8-in. pipe cleaned. The pressure required for the delivery of 400 gal. per min. before cleaning was 140 lb., while after cleaning 450 gal. per min. were delivered through the main with a pressure of 49 lb. The cost of cleaning the pipe was $2,083.32. Through this cleaning the coal consumption for pumping was reduced 722 tons per year, a saving of over 110 per cent on the cost of cleaning, at the present cost of coal.

A total of 5,267 ft. of 4-in. pipe was cleaned at a cost of $842.72. The pressure before cleaning was 125 lb. on a delivery of 150 gal. per min., while the pressure required on a delivery of 175 gal. per min. was 65 lb.

A total of 11,554 ft. of 8-in. pipe was cleaned, the deposit removed from pipe amounting to about 16 tons. Before cleaning the main, 140 lb. pressure was required to deliver 400 gal. per min. After cleaning, the delivery was 498 gal. per min. at 70 lb. pressure, a decrease of 50 per cent in pressure with an increase of 20 per cent in water delivery. Upon examination, the interior of the pipe was found to be reduced to 7 in., but by actual tests the carrying capacity was only that of a 5 in. pipe, showing that the interior roughness of the pipe caused by the incrustation reduced the carrying capacity more than the actual reduction in area. The saving in fuel effected by cleaning the main in this instance amounted to $2,200 per year.

Hallidayboro, Ill.

A total of 4,271 ft. of main was cleaned. An examination of the pipe before cleaning showed that the area had been reduced from 6 in. to 4½ in. Before cleaning the pumps were delivering approximately 200 gal. per min. with a pressure of 140 lb. per sq. in. After cleaning the delivery was 250 gal. per min. with a pressure of 40 lb. per sq. in., the static head being 30 lb. The saving effected through cleaning the main was $900 per year in fuel and $250 per year in labor.

An interesting account of cleaning of water mains is that of the Elgin, Joliet & Eastern at the East Joliet shops and yards. The mains cleaned at this point consisted of 8,365 ft. of 8-in. pipe serving two tanks, one of 200,000 gal. capacity and one of 100,000 gal. capacity. This large storage capacity was of great help in cleaning the mains, as it permitted of shutting down the pumps for a greater length of time than would have been the case with less storage capacity.

The cleaning was accomplished with cutting tools similar to those shown in the photographs. These were dragged through the pipe by a cable or forced through by water pressure. The first opening in the main was made at the pumps by removing a check valve. The second cut was made 200 ft. distant from the pump where the line was laid through rock. This necessitated quarrying out the trench to give room for the cleaning operation in advance of shutting down the pump. There were a large number of fittings in the line laid from the pump. These fittings consisted of a check valve, a reducing tee, 3 ft. of wrought iron pipe, a 45-deg. bend, 4 ft. of wrought iron pipe and an 8-in. by 3-in. by 8-in. wrought iron "Y," then 100 ft. of pipe laid in the foundation wall of a large building, thence to the street through a 45-deg. bend. This great number of fittings necessitated making a cut of only 200 ft. in length.

It was found impossible to drive the regular cleaning machine by the first wrought iron 45-deg. bend on account of a heavy shoulder formed by the pipe for an extra heavy special. Therefore, the machine was handled with a special carrier.

The machine was handled with a cable and the cable, laying close up to the pipe, pulled the shoulder of the machine into the recess formed by the special. In order to center the cable in the main a lead cone was moulded on the cable head of the machine. The second drawing gave no trouble, as it was straight pipe and in full sight of the pumping station, which was important in handling the operation of the pumps by signals to the engineer.

The third drawing was made with the intention of cleaning 1,300 ft. at one cut in order to avoid excavating in a newly paved street. This cut contained a 90-deg. bend, 200 ft. from the starting point and a 45-deg. bend 30 ft. from the end through which it was the intention to draw. It was thought that the 90 deg. bend had been made with two 45-deg. fittings, but unfortunately the machine stopped at this corner and it was impossible to get it any farther without cutting the main. Excavating at this point, cutting the pipe and getting things in shape for another cut caused a delay of two days. Upon cutting the line at the 90 deg. bend, 62 lb. of lead was found bunched up in a length of 18 in. This was undoubtedly the cause of the machine sticking at this point. To add to the difficulty this necessitated making three breaks in the pipe and two draws, the last of which was in a swamp, which meant that it was necessary to contend with water from the time the hole was opened until it was filled and on account of the great amount of work the tanks were out of water before the main was placed back in service.

From this point to the creek in the yards the next four draws, 1,200 ft., 1,700 ft., 1,500 ft., and 1,000 ft. in length, were made without further trouble other than the difficulty of handling the equipment over slag dumps, etc. It might be mentioned in passing that in many places the main was 40 ft. below the surface. The last drawing, 800 ft. in length, was made through a yard, passing under 52 tracks and through several 45-deg. bends. However, this drawing was made without any particular difficulty.

The pressure on this main before cleaning was normally from 145 to 160 lb. and there were times when it was necessary to carry as high as 175 lb. to maintain the required supply of water. The pressure required after cleaning was from 65 to 75 lb.

Probably the greatest trouble from incrustation in water mains on railroads occurs at points where water is

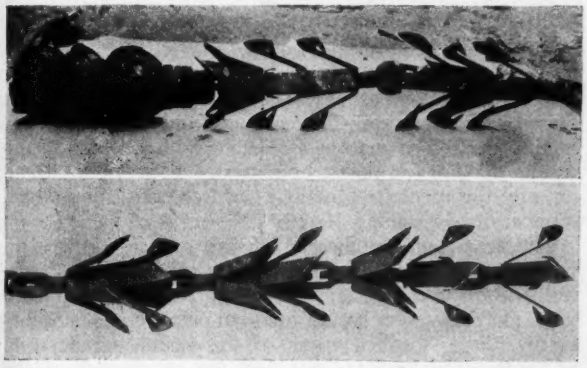
treated for locomotive use as incrustation of water mains invariably follows the handling of treated water regardless of how complete the treatment may be, although the rapidity with which the incrustation takes place will depend upon the extent of treatment, reaction time and filtration.

The incrustation from treated water is, of course, caused by the after precipitation and it is impossible to eliminate the resultant incrustation entirely, though it may be decreased by extending the reaction time and by the use of filters.

An analysis of the incrustation found in a pipe line handling treated water on a northern railroad is as follows:

Ingredient	Per Cent
Silica	2.30
Oxides of iron and aluminum	.60
Carbonates of lime and magnesia	97.10
Total	100.00

In this case the incrustation on the pipe line varied from about 2 in. in thickness in the pumping station to about ⅛ in. at the storage tanks three miles distant. Upon examination this incrustation was found to be in the form of an annular ring of a whitish substance and was very



An 8-in. Pressure Machine and a 6-in. Cable Machine

hard where it came in contact with the pipe, gradually becoming softer towards the center. It is estimated in this case that the incrustation formed roughly at the rate of about ¼ in. per year.

The results from cleaning a 6-in. main at Missouri Valley, Iowa, were as follows:

First cleaning—

Water pressure before cleaning	125 lb.
Water pressure after cleaning	35 lb.
Speed of pump before cleaning	18 r. p. m.
Speed of pump after cleaning	40 r. p. m.
Water delivered in tank before cleaning	11,000 gal. per hr.
Water delivered in tank after cleaning	20,000 gal. per hr.

Result of second cleaning—six years later—

Water pressure before cleaning	115 lb.
Water pressure after cleaning	35 lb.
Speed of pump before cleaning	18 r. p. m.
Speed of pump after cleaning	40 r. p. m.
Water delivered in tank before cleaning	10,000 gal. per hr.
Water delivered in tank after cleaning	25 000 gal. per hr.

In each case the internal diameter of the pipe was reduced to about 2½ in. in diameter, the incrustation being thickest near the pump, gradually diminishing towards the tanks.

Too much importance cannot be placed upon the proper size and condition of water mains, particularly the discharge lines from pumps, as no matter how efficient the pumping machinery may be, water cannot be pumped economically where excessive pressure is required to drive the water through pipe lines inadequate in size or reduced in area through incrustation.

THE MAINTENANCE OF SWITCHES AND FROGS

By W. F. Rench

THE PROPER care of switches and frogs is one of the most important duties in the maintenance of way department. It may be classed as a never-ending responsibility. The point switch is nearly as old as the railroads, having been in use for nearly a hundred years. The stiff frog dates from the beginning of railroads and the spring rail frog has been known for over half a century. These means of passing the wheels from one track to another will probably never be replaced by any other contrivance. Simple as the frog and switch are, they require persistent care for their correct functioning, not only to conserve economy, but as a necessary element in safe operation.

The switch consists of the ties, the two switch points, rods for holding the points in proper arrangement with respect to each other, plates for supporting the switch rail and for maintaining the position of the stock rail, braces to prevent the stock rails pushing out or turning over and a mechanism through which the switch may be thrown. The several fixtures are joined together by bolts, rivets and the spiking upon the ties. It is necessary that all the various parts of the mechanical device be kept in their correct relative positions.

The essential requirement in a switch is that the switch stand and other connections of the switch shall be in such exact adjustment that close contact is obtained between the switch point and stock rail, not only at the point of switch, but throughout the whole extent of the planing. The rules of most roads fix the limit of permitted deviation from the ideal condition as an opening not exceeding ⅛ in., the interlocking connections, if any are used, being adjusted to foul at 3/16 in. Since this applies equally to both points, or, if there is preference of one over the other, to the turnout point especially, because the wheels are to be directed through it into a different course, the inspection should be made of both points concurrently.

If there should be a lack of fit, the gage being correct, a means is required of bringing the points into their true positions relative to each other. When the switch rods employed are of the adjustable type this may be accomplished easily. If the clips are bolted to the switch rail and the rod is too short, the insertion of a washer or two between the switch point and the clip will usually furnish the desired correction. If the construction does not permit of such adjustment, or the rod is too long, the alternative is a different switch rod or the blacksmithing of the incorrect one. For making such tests and corrections it is useful for the foreman or supervisor to remember the standard distance between the centers of bolt holes for each rod of a switch, so that he can detect by measurement any discrepancy that exists.

It is the common practice to unite the switch rod and clip by means of a bolt, which should have the nut turned upward so as to be seen readily; and, where the nut is to be secured by a cotter pin, the cotter should always be in place and be properly spread. The makeshift of simply dropping a bolt or spike into the hole between the clip and the rod is a serious error, as it is liable to be jarred out and cause an accident. A bolt with nut may be obtained readily, and it can be applied more easily with the nut upward than the reverse.

The proper care of switches requires that the two stock rails shall be maintained in good condition, as this is not only necessary from the safety standpoint, but is desirable as a means of saving the wear and chipping off of the switch points. Renewing the stock rail without

disturbing the switch is always a more or less troublesome operation. Difficulty is usually experienced in getting the rail to seat itself in the grooves of the switch plates. If care is taken to clean off the plates thoroughly the rail may be brought into place with a minimum of effort by throwing the switch point over against it with a regular movement of the switch lever.

A common defect at switches, even those in a main track, is the tendency of the points to rise. Besides entailing severe wear upon the point, this furnishes a live source of derailment. The cause will almost always be found in loose ties at the heel of the switch. Naturally when one end of the switch point is depressed, the other end will tend to rise. The head rod is designed to hold the points down, but it cannot perform this duty entirely if the surface is not maintained at the heel of the switch. For this reason it is specially desirable that the splice bar used at the heel of the switch shall be modified only as may be necessary to allow the switch rail to be set at the proper heel gage. Keeping the bolts in the heel joints tightened is a further provision for avoiding this defect at switches. It should be a routine duty of the trackwalker to tamp the joint at the heel of switches periodically, and to tighten the bolts in the joints of switches frequently, and the efficient foreman will see that these duties are performed.

The soundness of the head ties carrying the switch stand is an important factor in the correct maintenance of switches. Unless the switch stand remains firmly in its established location lost motion develops in the ground connections, which not only causes a noisy rattling when trains are passing over the switch, a feature disconcerting to the passenger, but may become an active source of danger to traffic. A further need is that these ties shall be tamped solidly at all times. Besides the general maintenance defect brought about by a loose condition of the ties, delay is entailed through the switch lights, when these are carried upon the switch stands, being put out by the jarring motion.

The general maintenance question is best met by proper drainage. Adequate drainage at switches and frogs is an indispensable provision in winter when the freezing of ice about the working parts would quickly obstruct their movement. It is a precaution at all times against the development of indifferent surface which would make correct maintenance difficult of attainment. It is not an uncommon practice to apply stone ballast through the extent of the switch rails in tracks where at other points a lighter ballast might be regarded as sufficient. When a natural drainage is not available the necessities of the case may be taken care of by the installation of sewers or by the creation of sump holes close to the switches. It is a routine requirement of maintenance that some outlet shall be provided for the drainage of all switches.

An unequal bearing of the switch rails upon the riser plates not only makes for indifferent riding, but throws an undue burden upon the switch rail, inviting fracture. Modern practice requires the use of a plate on every tie throughout the switch rails. The ties should be adzed to a level and be so tamped as to afford an even bearing for the switch rail upon every plate. The plates require frequent oiling, not only for the easy working of the switch, but as a means of preserving the plates against wear and corrosion. The unfavorable condition brought about by unnecessary sanding over switches may be controlled by proper report of such occurrences. As a safety consideration dirt will also be kept out of switches.

The creeping of switches is a frequent source of trouble which not only disturbs the adjustments throughout the connection, but imposes an especially heavy duty upon the switch stand. When the creeping has advanced to the point where the rods press upon the head ties there is danger that the switch will not close properly and, further, an unnecessary exertion is required for throwing the switch, which becomes a serious matter when a "running" switch is being made. Securing the two rails which connect with the switch points against creeping by an ample use of rail anti-creepers is a provision for safety as well as for economy.

Maintenance of good surface and line through switches is seldom obtained. The elevation of the switch rail, which is a necessary precaution against the effect of the so-called false flanges, introduces a difficult problem in surfacing, and the susceptibility of switches to trouble from rail creeping complicates the maintenance of good line. The fact that many switches *do* ride well under high speed operation demonstrates that this problem can be solved. The first essential is good ties beneath the switch; the second is the correct use of the level board, allowing for the "humping" of the switch rail, if it is present; and the third is a careful and frequent lining, by respiking if necessary. Adequate protection against creeping by the use of rail anti-creepers at the approach to switches, and, where necessary, between the frog and switch, are of distinct aid in solving the problem.

When switches are taken out of service temporarily it is common practice to spike the switch. This is not a certain protection, as cases have been known where a switch apparently spiked securely has been thrown over by the exertion of man power. The addition of a clamp on the main track point, or a wedge between the main rail and the turnout point, is a further precaution which is generally desirable.

The repair of switches which fail or are damaged in accident requires resourcefulness on the part of the trackwalker or foreman. It is a wise precaution to have a stock of repair parts handy for such occurrences. Ability to reverse the broken crank of the switch stand, or to make the adjustments provided for in several of the more modern types of switch stand, may be the means of saving considerable delay to the movement of trains. A switch rod close at hand, a few switch bolts, or in extreme cases the clamp or wedge needed to secure the damaged switch, makes for efficiency.

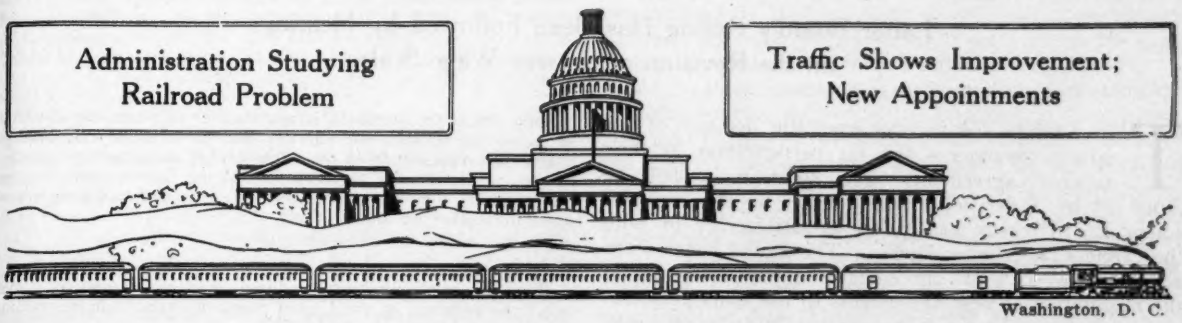
The maintenance of the stiff frogs in track covers only the proper provision of good ties beneath them, with such tightening of the bolts, tamping of the joints at toe and heel, and general lining as may be required. The care of spring rail frogs is a more detailed question. The spring rail frog is generally regarded as the economical type of frog for connections through which a moderate traffic is carried on the turnout side at moderate speed. The main rail is virtually closed and wear due to impact is reduced, while smoother riding is obtained.

The principal points to be guarded against are that the spring rail does not rise or the frog become distorted through the creeping of the spring rail. Spring rail frogs are generally provided with a holding down device and many are equipped with an anti-creeping strap. It is the business of the track foreman to see that these devices are properly maintained. It is here no less than in the switch that adequate tamping will have its effect in reducing the likelihood of the spring rail rising. It is important that connections having spring rail frogs be afforded due attention. The easy and quiet riding of cars over a well-maintained spring rail frog is one of the first things to impress the observant traveler. The matter of lubrication should not be overlooked, so that in no circumstance will the spring rail fail to return to its normal position against the point after the passing of wheels.

RAILWAY AFFAIRS AT THE NATION'S CAPITAL

Administration Studying Railroad Problem

Traffic Shows Improvement; New Appointments



Washington, D. C.

THE RAILROAD PROBLEM is occupying a large share of the attention of the new administration. The President and many branches of the government are giving the matter close study, and while the subject is being approached mainly from the standpoint of those who are complaining of the effect of the high cost of transportation on general business conditions, some thought is also being given to the idea that the railroads can do little to help the general business situation until their own condition is improved.

Alarmed at the reports showing the steadily increasing deficits of the railroads, which for the six months since the rates were advanced have been earning at the rate of only 2.5 per cent on their valuation and which in January and February had an actual loss of $8,000,000, and also by the numerous complaints of high rates, President Harding on March 3 began a series of conferences for the purpose of informing himself on the situation. He first called in Chairman Clark of the Interstate Commerce Commission and Chairman Barton of the Railroad Labor Board and since then he has talked with the heads of the various labor organizations and representatives of the railroad executives and the association of railroad security owners. In his address to Congress on April 12 the President declared that rates and the cost of operation must be reduced, but he did not suggest any plan of legislation for dealing with the situation, and up to this writing he has not indicated that he has found any solution for the problem better than to let it be worked out by the two bodies constituted by law to deal with the question.

No Rate Decrease Without Wage Cut

Chairman Clark has stated plainly on several occasions that there can be no general reduction in rates until the way has been paced for a reduction in the cost of operation, and since the President took up the matter the Railroad Labor Board has rendered its decision on the national themselves expect to be able to effect considerable economies in ways which they do not have to ask the authority of the government to put into effect, but under the law the only way in which they can reduce the $3,700,000,000 payroll without the action of the labor board is to lay off men.

President Harding in his address to Congress expressed approval of the proposed investigation by the Senate committee on interstate commerce into the railroad situation and the Senate on April 19 adopted the resolution introduced by Senator Cummins providing for inquiry into the following matters:

First. The operating revenues and expenses of the railroads of the country which under the law make reports to the Interstate Commerce Commission, comparing these revenues and expenses with like revenues and expenses (including the period of federal control) since 1912.

Second. The reasons which led to the extraordinary cost of maintenance and operation from March 1, 1920, to March 1, 1921.

Third. The reasons which induced the diminished volume of traffic in the latter part of the year 1920 and first two months of 1921, and in that connection the influence of the increased freight and passenger rates prevailing during that period.

Fourth. The efficiency or inefficiency of railroad management during federal control and during the year beginning March 1, 1920, and the efficiency or inefficiency of labor employed by the management during the same periods.

Fifth. The best means of bringing about a condition that will warrant the Interstate Commerce Commission in reducing freight and passenger rates.

Traffic Shows Improvement

Hearings are to begin about May 2 and the railroad executives are to be called as the first witnesses.

The slight improvement in the volume of traffic which was reflected in the weekly car loading reports for the first week in March was not maintained and there were further reductions each week, from 712,822 cars for the week of March 5 to 666,642 in the week of April 2, but there was a considerable improvement during the week of April 9, when the number of cars loaded with revenue freight was 693,719. While the loading of merchandise and miscellaneous freight, which for the week of April 9 amounted to 449,493 cars, has been increasing ever since the first of the year, this increase had been offset by a steady decrease in the coal movement. During the week of April 9 the coal movement began to pick up slightly and estimates indicate a further increase during the week of April 16. The number of surplus cars has continued to increase and for the week of March 31 it was 495,904, which was a new high record.

New Appointments

President Harding has appointed James C. Davis, general counsel of the Railroad Administration, and formerly general solicitor of the Chicago & North Western, as director general of railroads, to succeed John Barton Payne. He has also appointed three new members of the Railroad Labor Board, Ben W. Hooper, formerly governor of Tennessee, to succeed Henry Hunt of the public group; Samuel Higgins, formerly general manager of the New York, New Haven & Hartford and later with the Vapor Car Heating Company, to succeed W. L. Park of the railroad group, and W. L. McMenimen, deputy president of the Brotherhood of Railroad Trainmen, to succeed J. J. Forrester of the labor group. The three members who retire were originally appointed for only one year. The new appointments are for a five-year term. The Senate has confirmed the appointments of M. W. Potter and John J. Esch as members of the Interstate Commerce Commission and the President is to make two appointments to fill the remaining vacancies.

NATIONAL AGREEMENTS WILL END ON JULY 1

Labor Board's Ruling Has Been Followed by Hearings on the Revision of Present Wage Scales

THE LONG controversy over the demand of the railway employees for the perpetuation of their national agreements was suddenly ended on April 14 by a decision handed down by the Railroad Labor Board which was hailed as satisfactory by both the carriers and the employees. The award ordered the abrogation of national agreements on July 1, remanded the negotiation of new agreements to the individual carriers and their own employees, and upheld the railroads' interpretation of the principle of collective bargaining and their contention that varying local conditions should govern in fixing rules and working conditions. In these respects the decision was favorable to the railroads. The award also outlined 16 principles with which the agreements formed in this manner should be consistent. This is one of the chief points for which the employees' representatives have been fighting. Accordingly, both sides have expressed satisfaction with the terms of the decision.

After outlining the history of the controversy the decision said in part:

The carriers parties hereto maintain that the direction of this Board in Decision No. 2, extending the National Agreements, orders, etc., of the Railroad Administration as a *modus vivendi* should be terminated at once; and that the matter should be remanded to the individual carriers and their employees for negotiation and individual agreement.

The organizations maintain that the National Agreements, orders, etc., with certain modifications desired by the employees should be held by this Board to constitute just and reasonable rules; and should be applied to all carriers parties to the dispute, except to the extent that any carrier may have entered into other agreements with its employees. They maintain that local conferences requiring necessarily the participation of thousands of railroad employees for several weeks would constitute an economic waste and would produce a multiplicity of controversies as well as irritation and disturbance. They also urge that to require local conferences would be to expose the local organizations on the several carriers to the entire power and weight of all the carriers acting through the Association of Railway Executives on the conferring carrier, that such a disparity of force would produce an inequitable result highly provocative of discontent and likely to result in traffic interruptions. They, accordingly, insist that the conference should be national.

The carriers maintain that rules negotiated by the employees and officers who must live under them are most satisfactory, that the participants in such negotiations know the intent of the rules agreed to and advise their fellow workmen and officers accordingly, thereby avoiding a litigious attitude on both sides, that substantial differences exist as between the several carriers with relation to the demands of the service, necessary division of labor and other factors which differences should be reflected in the rules, that these local differences can be given proper consideration only by local conferences. The carriers refuse to confer nationally.

The Labor Board is of the opinion that there is merit in the contentions of each party and has endeavored to take action which will secure some of the advantages of both courses.

This Board is unable to find that all rules embodied in the National Agreements, orders, etc., of the Railroad Administration constitute just and reasonable rules for all carriers parties to the dispute. It must, therefore, refuse the indefinite extension of the National Agreements, orders, etc., on all such carriers as urged by the employees.

This Board also deems it inadvisable to terminate at once its direction of Decision No. 2 and to remand the dispute to the individual carriers and their employees. Such a course would leave many carriers and their employees without any rules regulating working conditions.

To secure the performance of the obligation to confer on this dispute, imposed by law on officers and employees of carriers, to bring about the recognition in rules of difference between carriers where substantial, to preserve a degree of uniformity in rules regulating subject matters of a general nature, to prevent to some extent the operation in negotiations of a possible disparity of power as between the carriers and their employees, and to enable the representatives of employees of each carrier and the officers of that carrier to participate in the formulation of rules under which they must live, the Labor Board has determined upon the following action:

DECISION.

1. The direction of the Labor Board in Decision No. 2, extending the rules, working conditions and agreements in force under the authority of the United States Railroad Administration, will cease and terminate July 1, 1921.

2. The Labor Board calls upon the officers and system organizations of employees of each carrier parties hereto to designate and authorize representatives to confer and to decide so much of this dispute relating to rules and working conditions as it may be possible for them to decide. Such conferences shall begin at the earliest possible date. Such conferences will keep the Labor Board informed of final agreements and disagreements to the end that this Board may know prior to July 1, 1921, what portion of the dispute has been decided. The Labor Board reserves the right to terminate its direction of Decision No. 2 at an earlier date than July 1st with regard to any class of employees of any carrier if it shall have reason to believe that such class of employees is unduly delaying the progress of the negotiations. The Board also reserves the right to stay the termination of the said direction to a date beyond July 1, 1921, if it shall have reason to believe that any carrier is unduly delaying the progress of the negotiations. Rules agreed to by such conferences should be consistent with the principles set forth in Exhibit "B," hereto attached.

3. The Labor Board will promulgate such rules as it determines just and reasonable as soon after July 1, 1921, as is reasonably possible and will make them effective as of July 1, 1921, and applicable to those classes of employees of carriers parties hereto for whom rules have not been arrived at by agreement.

4. The hearings in this dispute will necessarily proceed in order that the Labor Board may be in position to decide with reasonable promptness rules which it may be necessary to promulgate under Section 3 above.

5. Agreements entered into since March 1, 1920, by any carrier and representatives of its employees shall not be affected by this decision.

Exhibit "B," mentioned above, sets forth the principles believed by the board to be just and reasonable in governing working conditions as follows:

1. An obligation rests upon management, upon each organization of employees and upon each employee to render honest, efficient and economical service to the carrier serving the public.

2. The spirit of co-operation between management and employees being essential to efficient operation, both parties will so conduct themselves as to promote this spirit.

3. Management having the responsibilty for safe, efficient and economical operation, the rules will not be subversive of necessary discipline.

4. The right of railway employees to organize for lawful objects shall not be denied, interfered with or obstructed.

5. The right of such lawful organization to act toward lawful objects through representatives of its own choice, whether employees of a particular carrier or otherwise, shall be agreed to by management.

6. No discrimination shall be practiced by management as between members and non-members of organizations or as between members of different organizations, nor shall members of organizations discriminate against non-members or use other methods than lawful persuasion to secure their membership. Espionage by carriers on the legitimate activities of labor organizations or by labor organizations on the legitimate activities of carriers should not be practiced.

7. The right of employees to be consulted prior to a decision of management adversely affecting their wages or working conditions shall be agreed to by management. This right of participation shall be deemed adequately complied with, if and when, the representatives of a majority of the employees of each of the several classes directly affected shall have conferred with the management.

8. No employee should be disciplined without a fair hearing

by a designated officer of the carrier. Suspension in proper cases pending a hearing, which shall be prompt, shall not be deemed a violation of this principle. At a reasonable time prior to the hearing he is entitled to be apprised of the precise charge against him. He shall have reasonable opportunity to secure the presence of necessary witnesses and shall have the right to be there represented by a counsel of his choosing. If the judgment shall be in his favor, he shall be compensated for the wage loss, if any, suffered by him.

9. Proper classification of employees and a reasonable definition of the work to be done by each class for which just and reasonable wages are to be paid is necessary, but shall not unduly impose uneconomical conditions upon the carriers.

10. Regularity of hours or days during which the employee is to serve or hold himself in readiness to serve is desirable.

11. The principle of seniority long applied to the railroad service is sound and should be adhered to. It should be so applied as not to cause undue impairment of the service.

12. The Board approves the principle of the eight-hour day, but believes it should be limited to work requiring practically continuous application during eight hours. For eight hours' pay, eight hours' work should be performed by all railroad employees, except engine and train service employees, regulated by the Adamson Act who are paid generally on a mileage basis as well as on an hourly basis.

13. The health and safety of employees should be reasonably protected.

14. The carriers and the several crafts and classes of railroad employees have a substantial interest in the competency of apprentices or persons under training. Opportunity to learn any craft or occupation shall not be unduly restricted.

15. The majority of any craft or class of employees shall have the right to determine what organization shall represent members of such craft or class. Such organization shall have the right to make an agreement which shall apply to all employees in such craft or class. No such agreement shall infringe, however, upon the right of employees not members of the organization representing the majority to present grievances either in person or by representatives of their own choice.

16. Employees called or required to report for work, and reporting but not used, should be paid reasonable compensation therefor.

WAGE HEARINGS BEGIN

On April 18 the Labor Board took up the wage question as a hearing on the disputes between 92 railroads and their employees. These were consolidated into one case, although each carrier was granted the right to make a separate presentation. The fact that the three new members of the board were not present at the beginning of the hearing led to a protest on the part of the employees' representatives, but this was overruled by the board, which proceeded with the case. Under the procedure followed the railroads presented their side of the case first and as we go to press their representatives are still before the board and the employees' side has not yet been presented. The remainder of the testimony, including that presented by the employees, will appear in next month's issue.

There is no uniformity in the demands being made of the board by the various roads. Some are asking for reductions in the wages of practically all of their employees, others for reductions in the wages paid unskilled labor, others for reductions in the wages of various classes of employees, the wage scales to vary according to the varying local conditions, while still others are asking for a return to the wage scales in effect prior to Decision No. 2.

Briefly, the contention of the railroads as outlined in the various presentations is that the wages should be reduced for the following reasons: The cost of living has reduced very materially from the level prevailing at the time of the last increase in wages. It is possible to employ labor, particularly common labor, at rates appreciably lower than those now being paid, as evidenced by the wages actually in force in other industries and in work done by contractors. The financial condition of the railroads make reductions in wages imperative. Wages should be varied to meet the wide range of conditions as to cost of living and prevailing rates of pay in various localities.

The railroads' arguments for wage reductions were opened by J. G. Walber, speaking in behalf of the eastern carriers, and taking up those arguments which are common to all of the roads in that territory.

Mr. Walber presented a memorandum and statistical exhibits showing the reductions in wages in other industries and in the cost of living which have occurred since the present railway scales were fixed by the Railroad Labor Board in July, 1920. He submitted statistics regarding the reductions in the cost of living, based upon compilations made by various commercial agencies and also by the Bureau of Labor Statistics and the National Industrial Conference Board.

"The latest figures available from the Department of Labor," he said, "are for the period ending December, 1920, while the National Industrial Conference Board has compiled its figures to March, 1921. By reference to the declines from the peak (July, 1920, when the present wages were fixed) to December, 1920, as shown by these tables, it was observed that the Department of Labor statistics indicate a decline in the cost of living of 7.4 per cent, and the figures of the National Industrial Conference Board a decline of 7.1 per cent. The decline to March, 1921, according to the figures of the National Industrial Conference Board, is 17 per cent, and if the Department of Labor figures for March, 1921, were available it is reasonable to assume that the similarity in the results obtained by both organizations would have continued."

Following Mr. Walber's general presentation on behalf of the eastern lines, a statement was made on behalf of the railways in New England. In this statement the changes which have occurred in the cost of living in New England, as disclosed by the report of the Special Commission on the Necessaries of Life in Massachusetts, were particularly dealt with. This showed that in July, 1920, when the present wages were fixed, the cost of living in Massachusetts was 102.6 per cent more than in 1913, while in March, 1921, it was only 66.4 per cent more than in 1913. The reduction shown in the cost of living since the present wages were fixed was 35.3 per cent. The statement on behalf of the New England lines also called attention to the serious financial condition of those roads: "Your petitioners believe that the financial condition of the employers is worthy of some consideration. The regular reports of results of operation of the New England lines, which are matters of public record, show that even with the recent increase in rates your petitioners are failing by a substantial sum to meet costs of operation, to say nothing of fixed charges. This situation exists notwithstanding the most drastic economies which can be exercised, having due regard for the safety of operation."

The statement of the Chicago & North Western presented specific facts on the reduced rates of pay for which it would be possible to recruit all the labor necessary for section gangs in various parts of its line. This had been obtained through questionnaires addressed to the roadmasters. This in part is as follows:

"There are 178 sections where labor may be secured at less than 40 cents an hour; four sections at 42½ cents an hour; 98 sections at 45 cents an hour. Since this data was secured we have followed the prevailing rates for similar common labor and find that labor agencies in the city of Chicago during the week ending April 16 were supplying labor to outside industries at from 25 to 35 cents per hour. On April 11 one labor agency furnished 10 laborers for nursery work at the rate of $2.25 per day for 10 hours. One labor agency furnished 25 common

laborers to an independent contractor who was doing work for the Chicago Great Western at 30 cents per hour. One Italian labor agency on Halsted street advised that it could furnish Italian laborers for track work and extra gang work, and that such men were seeking employment at 35 cents per hour."

In addition to the above, detailed statistics were presented to show reductions in the rates being paid in the large industrial centers in Chicago. This covered coal dealers, lumber companies, box manufacturers, packing houses, etc.

Similar data were presented by the Illinois Central to serve as a request that a sliding scale of wages be established for extra gang and other unskilled labor in the maintenance of way department, based on the differences in conditions in the various territories traversed by that railroad. As stated by L. W. Baldwin, vice-president:

"As the line runs from Chicago to New Orleans and Birmingham, it traverses sections of the country where living conditions have such wide variations, simple justice as well as the spirit and letter of the law forbid anything like a uniform basis of pay." Based on this conclusion, the following schedule was proposed:

"Northern and western lines: Present rates, 47½ to 48½ cents per hour. Reduce all rates 8½ cents per hour, establishing new rates of 39 to 40 cents per hour.

"Lines south of the Ohio river: Kentucky division: Present rates, 40½ to 43¾ cents per hour. Reduce all rates 8½ cents per hour, establishing new rates of 32 to 35½ cents per hour.

"Tennessee Division: We propose rates as follows: Ballard to Fulton, inclusive, 32 cents; Paducah to Fulton, 30 cents; Fulton to Woodstock, 27½ cents; Fulton to Jackson, Tenn., including Jackson, 27½ cents; Birmingham district (Corinth to Haleyville), 25 cents; Birmingham, Ala., 25 cents.

"Memphis and New Orleans Terminals: We propose rates of 32½ cents per hour.

"All other territory south of Ohio river: We propose rates of 25 cents per hour."

Further evidence of the inequality of a fixed rate of wage the country over is brought out in the statement of the Northern Pacific which outlines the great variation in employment conditions over the length of that system. Thus in wheat growing territories of the Dakotas there is a period during which there is plenty of surplus labor, comprising small farmers and farm boys, between the seasons of seed time and harvest, while at other times in the year it is necessary to import labor from distant points.

Another argument for reductions in wages was contained in the statement of the Chicago Great Western and hinges on the requirements for the Transportation Act for the exercise of economy by the railroads.

"The Transportation Act imposes upon the carriers the duty to honestly, efficiently and economically manage their property and to make only reasonable expenditures for maintenance of way structures and equipment, to the end that they may earn an aggregate net railway operating income equal to a fair return upon their aggregate value. The company respectfully submits that if under the facts as they exist today this board should decline to rescind Decision No. 2 and to permit the rates of wages now insisted upon by the company to become effective, it would prohibit the company from obeying that provision of the Transportation Act hereinabove last mentioned. In other words, it would not only itself defy the law, but would compel the corporation to disobey the law."

This same contention was met by the Santa Fe system in a somewhat different form. The fact that the railroads are paying more for their common labor than outside industry is subjecting them to considerable criticism. The Santa Fe statement and those of some of the other roads also point out that employment with the railroads carries with it emoluments and privileges supplemental to the wages paid. Thus, the Santa Fe furnishes free housing and fuel to a great proportion of its labor. This report also calls attention to the fact that whereas the Santa Fe is one of the soundest railroads in the country from a financial standpoint, this road has not earned its operating expenses for the last two months and that this experience of the Santa Fe indicates a serious situation as to all railroads.

ST. LOUIS SOUTHWESTERN CASE

On April 1 the St. Louis Southwestern came before the Board as a result of a resolution passed by the Board stating that it had reason to believe that that road had violated Decision No. 2 in cutting the wages of employees in pile driver, bridge and building paint gang, house gang and tinner services on November 25. W. A. Webb, vice-president and general manager, denied the charges in toto and stated that the only modification of Decision No. 2 made by the road was made by contract with individual men. J. C. Smock, representing the employees, submitted letters and affidavits to prove that the road had violated the principle of collective bargaining as outlined in the Transportation Act and that no conferences have been held in conformity with the provisions of the act. He charged the carrier with coercion and intimidation on the grounds that economic necessity made it necessary for the individual men to accept the contracts offered by the road for the work outlined above. The Board took the case under advisement and rendered a decision on April 14, from which the following summary has been prepared:

On December 1, 1920, the railroad issued a schedule of new rates of pay on the Waco division embodying considerable modifications from the Board's award of July 20. The road also "abolished" a large number of positions in the fall of 1920 and then re-employed the men through individual contracts executed between the men and the company.

Similar action was taken with regard to section foremen and track labor had been reduced from 41¾ cents per hour to from 25 to 33 cents in various territories, depending on the current wage for common labor.

It is found by the Labor Board accordingly that the persons performing the duties formerly allotted to the positions named in the resolution, or substantially such duties, are in fact the employees of the carrier, that the pretended abolition of such positions was not in good faith, but was a device to evade the obligations of Decision No. 2 of this Board. Such a device cannot and will not be allowed to prevail. It can easily be seen that if a carrier may evade the decision of the Labor Board by abolishing a position and re-establishing it as in this case, there is an end to any obligation to obey a decision of the Labor Board as to wages, if the carrier is willing to employ this subterfuge.

It is the decision of the Labor Board that this carrier restore the said positions and the pay, duties and obligations of said positions to what they were on July 20, 1920, as established by this Board's Decision No. 2; and it is further decided that the persons serving in said positions just prior to the effective date of the order of the carrier quoted above be reinstated therein if they so desire, and that each such person so reinstated receive pay equal to what he would have received, if occupying such position, at the rate provided by Decision No. 2 from the date removed or reduced in pay to the date of reinstatement, less what any such person may have earned by personal service in the meantime.

If the carrier shall make it appear to the Board that this decision requires the reinstatement of employees in excess of the requirements of the service, this decision will be modified accordingly.

INDICATIVE of the interest which is being displayed in the "What's the Answer?" column, one of our readers writes that he is calling this column to the attention of all of his foremen. Another writes: "It seems to me you have struck a very happy means of presenting information of value to your readers, as is evidenced by the questions on maintenance problems and the particularly comprehensive replies which have been made in most instances." Still another reader writes: "I have found this column of great interest; in fact, so much so that we make it a subject of discussion at our regular supervisors' meetings."

Are you, our reader, finding this column of similar interest and value? It is being conducted in your interest and in the hope that you will make full use of it whenever you are confronted with a problem for which you desire the solution. It is also expected that you will contribute freely of your experience to assist other railway men in the solution of their problems.

REPAIRING DAMAGED CONCRETE

What is the best way to patch or replace a piece of concrete knocked out of a parapet wall, a column, etc.?

The first requisite for a good patch is that the old surface be thoroughly clean and that it be roughened to afford the best possible bond with the new concrete. Another requirement is that the old concrete be thoroughly drenched with water. The object of this is to insure the presence of enough water in the old concrete so that it will not absorb the water out of the new concrete that is placed on the patch.

The new concrete may be placed either in a very wet condition supported by forms or as a moderately dry concrete, the idea in the former case being to insure the presence of enough water so that it will not be seriously affected by the loss from evaporation. Better results are secured with a moderately dry concrete tamped thoroughly into place, care being taken to see that the concrete is kept moist after it is placed.

Under some conditions it is advisable to hold the patch in place by dowels placed in holes drilled in the old surface. This is sometimes supplemented by adding some wire mesh in which case a fairly wet concrete must be used. Others favor the undercutting of the cavity to be filled much in the same way as a dentist would do it. This method is not frequently used, however.

ENGINEER OF DESIGN.

What Information Have You to Offer?

The following questions have been submitted and will be answered in the July issue:

(1) What kind of a break in an angle bar or other joint bar constitutes a dangerous condition requiring the removal of the bar immediately?

(2) What is an effective method for sealing vertical joints between steel work and concrete so as to prevent the corrosion of the steel? Particular reference is had to the problem presented in the use of concrete floors for through-girder bridges.

(3) What is the most practical and economical plan for replacing broken window panes in stations, pump houses and other buildings scattered along the railroad?

(4) Should an air chamber on a pump be fitted with an air cock and, if so, where?

EDUCATING TRACK MEN

What is the least time in which a trackman of average intelligence can qualify as a foreman?

Under the old system, where a track laborer could learn the important points in track work only by experience, it was generally conceded that a man should have at least three years of experience in track maintenance before he could safely assume the responsibilities of a track foreman. At that time, about the only available source of information for the laborer was his foreman, and, of course, the observation of the work as carried on from day to day.

A competent foreman must understand the basic principles of track construction and maintenance. In other words, he must know the "why" of track work. This used to be about the most difficult part of the beginners' track education. Until recent years little had been printed in any form suitable for study by a beginner and the available publications were not generally known to this class of workers. In fact, very little attention was directed toward the systematic study of track work. Experience was about the only available teacher, and the process of learning was correspondingly slow.

The need for practical track information in printed form has been well recognized within the past few years. At the present time there are a number of books and magazines devoted to such information. The trackman who wants to learn the "why" of track work finds a ready means of supplementing his experience with some excellent material for study. No doubt the best method for quick results is offered by a systematic course of study on track work which has been prepared especially for the purpose. In fact, such courses are being recommended by many railroad managements at this time, in order to increase the number of men suitable for promotion. Such a course of study may be taken by mail. Books and magazines on track work may be obtained for supplementary reading and study. A year of experience and study under these conditions will

do as much to educate a man in track construction and maintenance as three or four years of experience alone. Any trackman of average intelligence who has had a year or more of experience should be able to qualify for a position as foreman within an added six months to a year, if he will use some of his spare time in systematic study of the business.

WILLIAM KINSIE, Service Manager, The Railway Educational Bureau, Omaha, Neb.

FLOORS FOR TOILET ROOMS

What types of floors are the most sanitary and practical in maintenance for station toilet rooms?

A serviceable floor in a toilet room must be hard and smooth so that it can be cleaned readily with water. It should be proof against cracking and should be impervious so that it will not absorb moisture. The concrete provides a good hard surface and may be constructed so that it will not crack, but experience has shown that it is usually more or less absorbent. Based on experience with a number of kinds or floors, it is the opinion of the writer that the glazed tile or a particular make of composition floor, having much the appearance of a tile, will give the best results. Where the appropriation permits, a tile floor preferably dark red with 6-in. by 6-in. pieces makes almost an ideal floor. Where less money is available, the composition tile is recommended. This has proven impervious to moisture and has good wearing qualities. This composition tile is mounted on a concrete base and may be laid either on concrete construction or on a wooden sub-floor. It has the advantage that it can be formed with an integral base if desired. This should be reinforced with wire mesh to prevent cracking.

CHARLES P. RAWSON, architect, Chicago, Milwaukee & St. Paul, Chicago.

LEAKY TANK TUBS

How can a leak be stopped in the joint between the staves of a wooden tank?

Leakage in the joints between tank staves can be broadly said to be due to one of four general causes: (a) Poorly framed staves, (b) decayed or defective staves, (c) insufficient number of staves, (d) shrinkage of staves.

Poor framing resulting in a stave of varying widths from end to end is responsible for many leaks, especially in new tubs. This may be stopped in some cases by tightening the hoops at the point of leakage, but is bad practice unless carefully done, as it overstresses the hoops. The stave should be replaced by one of uniform width.

Decayed or defective staves should be either replaced or the leak stopped by cutting away the defective portion of the stave and fitting in a new piece of timber.

A fault to be guarded against in the erection of new tubs and one that frequently causes serious leakage between the staves is the failure to completely fill the circle formed by the bottom with staves. When this occurs the staves are pulled tight by the hoops at the top and to within a few feet of the chime, but the tank will continue to leak until sufficient staves are applied.

Leaks from shrinkage caused by staves becoming dry can usually be corrected by keeping the staves saturated or by tightening the hoops, but the latter must be done carefully to avoid undue stresses.

As a general thing it is bad practice to insert any foreign material between staves to stop leaks, as such material has a tendency to promote decay. With leaks occurring in old tanks more or less decayed it is, of course, advisable to caulk the joints with oakum or hemp. After caulking the joint should be painted with hot pitch and covered with tar paper.

C. R. KNOWLES, Illinois Central, Chicago.

PREVENTING PERSONAL INJURIES

By CHARLES H. SMITH

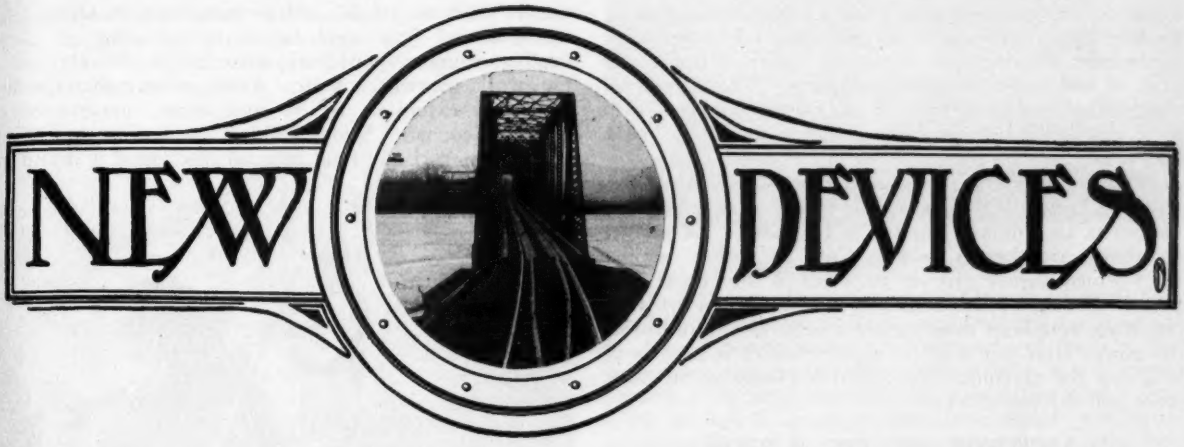
SOME roadmasters and supervisors seem somewhat inclined to take for granted that certain ordinary actions necessary in the routine performance of a trackman's duties will be executed correctly without any instructions regarding the proper methods to be used. The very simplicity of some duties encourages this belief. And yet even old and experienced foremen will sometimes "fall down" if questioned regarding some of these apparently simple duties which come under their observation every day in the year.

At a Safety First meeting which was held at a central point on a certain division of a middle west railroad the supervisor of safety questioned the foremen attending regarding some of these simple practices. The meeting was held especially for track foremen and practically every foreman on the division attended. Some of the men had been in the service for many years and could, therefore, certainly be classified as "experienced." The supervisor of safety had a list containing the name of every trackman who had been injured during the past year and he discussed each case separately, bringing out the cause of the accident and how it could have been prevented. By this method he hoped to prevent accidents of similar nature in the future.

The discussion during one period of the meeting centered on the case of a trackman who had been injured by having been run over by his own motor car when he had attempted to board it. This brought out the question, "What is the proper way to board a motor car?" referring, of course, to the type of car which must be pushed until the engine catches the spark and starts the car off under its own power.

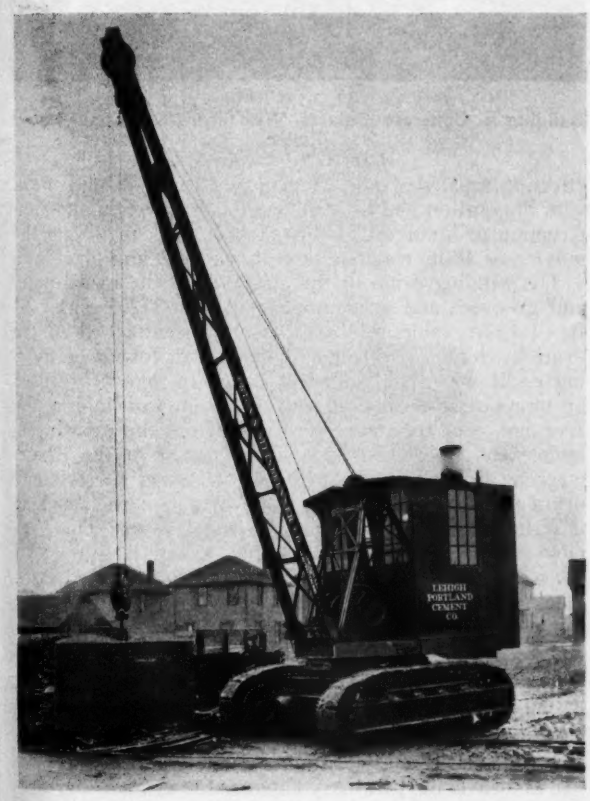
Although there were in the neighborhood of twenty track foremen present only one or two seemed able to answer this question correctly. The supervisor called on various foremen, all of whom gave unsatisfactory answers until he reached an old foreman having charge of a section on the western end of the division. This man replied in substance: "There is only one way to board a moving motor car correctly and this is from behind. I appoint two of my men as pushers. After we put the car on the rails and before moving it, the rest of us board the car and are seated. Then after every man is in his place the two pushers running behind the car start it forward. The practice of pushing a motor car from the side when starting it is dangerous, as a man cannot board a motor car from the side with any degree of safety after it gets under headway. Due to the danger of slipping I instruct the pushers to avoid stepping on the rails and for the same reason I tell them to exercise every caution when they step from the ground up to the platform of the car after the car has started moving under its own power.

The supervisor of safety commended this answer and declared it to be the one he was seeking and announced his surprise that every foreman could not answer this simple question correctly. This incident merely goes to show that roadmasters and other supervisory officers should not take for granted that their men are in possession of a knowledge of necessary methods—even when they use certain methods daily. In regard to this specific incident —boarding moving, motor cars correctly—it would be a wise plan to observe the men when making the next trip over the line via motor cars. In case the men do not board their cars correctly set them right. If they are using the proper method, commend them. Eternal vigilance may be the price of safety—but it is not all of the price by any means. Eternal education is also a most important factor and should not be neglected.



NEW REVOLVING TREAD TYPE OF CRANE

THE ORTON & Steinbrenner Company has recently added to its list of locomotive and material handling cranes, the revolving tread machine shown in the illustration. This crane was designed primarily to meet the need of contractors in excavating and various material handling projects, but is applicable for use by the railroads having similar problems around yards and outlying points. The machines are made in two sizes, rated at 7 and 12 tons capacity, respectively, and are equally adapted to operating a fall block, grab or drag line bucket, electro magnet or pile driver. Equipped with a ¾-yd. grab bucket, the 7-ton crane, which weighs about 45,000 lb., is said to permit the handling of any material, capable of being handled by a bucket at distances out to 30 ft.

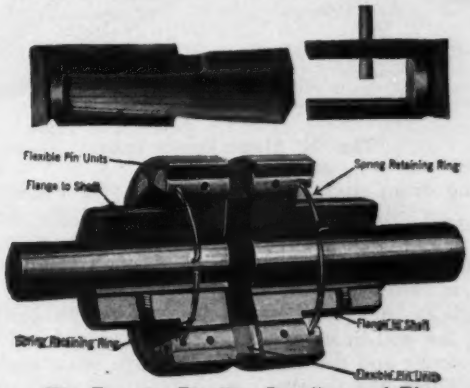


A Revolving Tread Crane Under Test

The revolving tread is built along the lines of that used on the government military tanks. With it the machine is said to be capable of crossing railroad tracks and similar obstacles without difficulty of traveling up grades of 20 to 30 per cent on soft material, and of turning around in a circle having a radius about equal to the length of the machine. In such cases steering is affected from the operator's stand. For ordinary purposes, of course, slewing of the boom is accomplished by revolving the turntable, this table being carried on twelve chilled rollers supported on a tee rail. The character of the construction of the crane as a whole is similar to that of the company's larger machines. The cab, frame and boom are made of structural steel. All machinery is of the gear drive type and is arranged so that the movement of hoisting, swinging, raising or lowering the boom, and of traveling can be affected successively or simultaneously. The frictions are bronze, and the engines are of the double-cyclinder, non-reversing type.

A FLEXIBLE COUPLING FOR SHAFTS

RAILROAD OFFICERS experienced in the care of power transmission machinery in shops, pumping stations, electric generating stations, etc., and consequently aware of the difficulty of accurately alining shafting and the trouble often entailed by misalinement, particularly in the case of direct-connected power units and other shafting supported by more than two bearings, will be interested in a flexible coupling which has recently been introduced in the railway field through the installation of a number of them on the New York Central. This coupling, a product of the Francke Company of Newark, N. J., and known as the Francke coupling, consists of two substantial cast iron or steel flanges (the material depending upon the requirements) which are

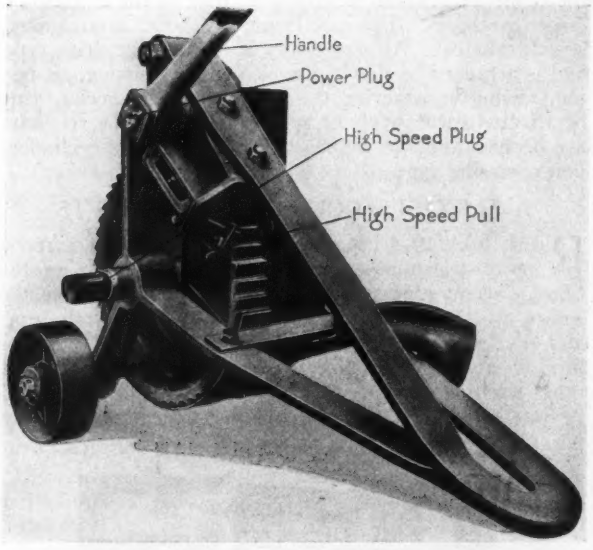


The Francke Flexible Coupling and Pin

keyed to the adjoining shafts and connected together by flexible steel pins instead of rigid pins. The flexibility in the pins is secured by the use of a core of thin plates held in end caps or keeper supports. This laminated core, being free of support at the center, having slotted ends, and being held pivotally rather than rigidly in the keeper supports by the cross pins, thus permits the movement in the coupling in three directions: endwise, sidewise, and radially. The pin units are inserted in the flanges as an ordinary pin, and in the case of the smaller couplings, are therein held in place by spring retainer rings which engage grooves provided in the keeper supports. Owing to the flexibility and resiliency of each pin, these couplings thus present a means of transmitting the power from one shaft to another which is capable of relieving the machinery of strain imposed by misalinement and driving shocks.

A JACK FOR PULLING PURPOSES

THE MAINTENANCE Equipment Company, Chicago, has recently added to its line of railroad appliances a portable, hand-operated device for use in work involving pulling or hauling. The device, known as the "K" Hand Power Puller, is shown in the accompanying illustration. It consists of a winding drum carried on a frame mounted on wheels and is operated by means of a 5½-ft. hand lever. This lever fits either one of two plugs, the lower plug being the extremity of the extended



The "K" Hand Power Puller

winding drum shaft, while the upper plug engages the drum gear through pawls. Obviously the upper plug affords greater pull, although less speed of operation, than the lower plug. When operating through this plug the drum is revolved by moving the lever back and forth through an angle of about 45 deg., the double pawls enabling the pull to be exerted at each forward and backward stroke and the system of leverage being such that the machine will develop a pull about 260 times greater than the pressures applied to the end of the operating lever. The capacity for pulling, which, of course, may be materially increased by the use of fall blocks in the haulage system, together with the machine's capability of working equally well in the air or on the ground and of being wheeled about by one man or carried by two (the machine weighs about 141 lb.), adapt it to a variety of uses in the railway field, such as stump or pile pulling, pile strengthening, guy wire tightening, rerailing of cars, loading or unloading of heavy materials, light bridge erection work, moving cars, etc. At the present time the device is in extensive use by contractors, house movers, wrecking concerns, bridge builders, lumber operators and similar enterprises. One railroad has found it useful in

Building a Concrete Culvert With the "K" Hand Power Puller

effecting repairs of pile clusters and bents around piers. The illustration shows it in use on the Erie in the construction of a culvert, this particular work involving the moving of 48-in. concrete pipe about 60 ft. and placing it.

The winding drum of the machine is 8 in. in diameter and grooved, and accommodates 55 ft. of ¾-in. or 65 ft. of ½-in. cable. This cable may be attached to the drum by threading through an eyelet, but for use in moving rocks, logs, etc., sufficient purchase may be secured by wrapping the cable around the drum and holding the free end. For the purpose of paying out the cable when under load, a reverse gear is embodied in the design whereby pressure on a small lever releases the winding drum notch by notch. The total height of the machine is 26 in., the width 22 in. and the length 28 in. The complete equipment includes four cables having lengths of 15, 45, 60 and 80 ft., respectively, and variously fitted ends, together with a special type of snatch block and a device for taking up the slack in the cable.

A RECENT DEVELOPMENT IN HEATING SYSTEMS

THE AMERICAN RADIATOR COMPANY, Chicago, has recently introduced a hot water heating system known as the Ideal-Arcola, intended primarily to meet the requirements of the small cellarless building, although it is said that, if properly laid out, it will give entirely satisfactory results in larger installations as well. This system is primarily an all-on-one-floor system; that is, it does not require the placing of the boiler in a pit or cellar. It consists simply of the Ideal-Arcola boiler with the proper number of radiators and necessary piping. The boilers are made up of cast iron sections ranging from 4 to 8 in number, depending upon the size of the installation, these sections being 17 in. wide and 43½ in. high. The water jacket of each boiler entirely surrounds the

fire pot and ash compartment, thereby eliminating the hazard from overheated fire bowls, and is fluted on the inside above the grates to provide a large heat radiation surface for the water. The fire pot has a large fuel holding capacity, a deep, snug-fitting ash pan provides the

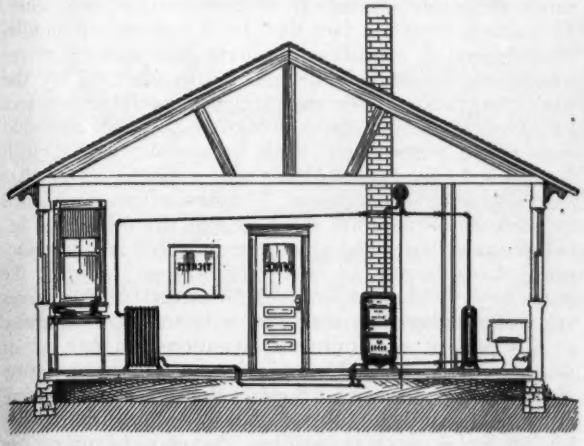
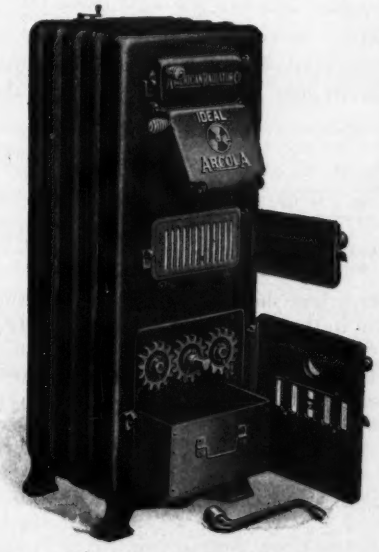


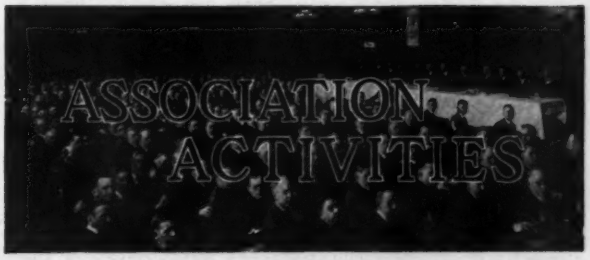
Diagram Showing Arrangement of Ideal-Arcola Boiler in Depot

means of removing ashes from the building, and simple devices conveniently located on the boiler provide the means of regulating the fire and draft. These outfits are made in five sizes and are shipped in the assembled condition, requiring only the setting in place and connecting to the radiators preparatory to operating.



The Ideal-Arcola Boiler

By setting the boiler up in the ticket office the meddling of unauthorized parties is eliminated, as is the labor and dirt involved in the attending of several fires, and also much of the irregularity in heating often experienced in stations heated by coal stoves not in the agent's immediate vicinity. Among the advantages claimed for it are that the system is clean, potential of effecting a uniform heating of the entire building, need not be dismantled each year and, according to the manufacturers, does not consume any more coal than the regular station heater. As a further means of simplifying the operation and of preventing tampering the system is designed to allow the elimination of radiator valves.



ROADMASTERS' ASSOCIATION

The executive committee met in Chicago on April 14 to consider the various problems confronting the association. It was decided to hold the next meeting of the executive committee, and the different committees who will present reports at the next convention, at the Statler hotel, Cleveland, on July 9, at which time these reports will be reviewed and put in shape for presentation to the convention.

AMERICAN RAILWAY ENGINEERING ASSOCIATION

As a result of the prompt attention given by the Board of Directors of the American Railway Engineering Association, the several standing committees have already been organized and have received their respective assignments of work for the year. The following is a statement of the new subjects assigned to the various committees together with the names of the chairmen of these committees.

While it is evident that a special effort will be made to complete the studies of the subjects now assigned, it will be noted that new subjects have been assigned to all committees excepting those on Yards and Terminals, Wood Preservation, Economics of Railway Labor and Shops and Locomotive Terminals. Of the chairmen, F. J. Stimson of the Committee on Ballast, W. A. Clark of the Committee on Ties, Maro Johnson of the Committee on Signs, Fences and Crossings, A. Montzheimer of the Committee on Yards and Terminals, and A. S. Going of the Committee on Economics of Railway Location are all new incumbents of their respective offices. All of them have had previous service with these committees.

Roadway—Study and report on the methods employed and results secured in the treatment of sliding cuts and fills and soft spots in excavation and embankment; the effect of heavier power and increased tonnage upon roadbeds previously considered stabilized; on methods for filling bridge openings; the relative economy and advantages of various methods of ditching earth cuts, cleaning and shaping roadway ditches, roadbed and ballast shoulders, with special reference to labor saving devices now in use, and the development of machinery for this purpose; chemical killing of weeds on and removal of killed weeds from the roadbed; the design and use of reinforced concrete culvert pipes; excess costs of maintenance during the early period of operation; methods of providing outside ditches for main track drainage without utilizing the main track for loading the excavated material; J. R. W. Ambrose, chief engineer, Toronto Terminals, Toronto, Ont.

Ballast—Submit a general review of the report on ballast tools, summarizing for convenient reference all important facts not contained in the manual; F. J. Stimson, chief engineer maintenance, Southwestern region, Pennsylvania System, St. Louis, Mo.

Ties—Study and report on the care of ties after distribution; study and report on classification of ties for various kinds of service; W. A. Clark, chief engineer, Duluth & Iron Range, Duluth, Minn.

Rail—Study and report a fair and correct method of reporting rail failures; G. J. Ray, chief engineer, Delaware, Lackawana & Western, Hoboken, N. J.

Track—Submit final plans and specifications, if practicable, for track tools; W. P. Wiltsee, assistant engineer, Norfolk & Western, Norfolk, Va.

Buildings—Study and report on the general subject of floors for railway buildings; W. T. Dorrance, designing engineer, New York, New Haven & Hartford, New Haven, Conn.

Wooden Bridges and Trestles—Study and submit a report on the best method of fireproofing wooden bridges and trestles; W. H. Hoyt, chief engineer, Duluth, Missabee & Northern, Duluth, Minn.

Masonry—Study and report on the developments in the art of making concrete; study and report on failures of concrete structures; J. J. Yates, bridge engineer, Central Railroad of New Jersey, New York, N. Y.

Signs, Fence and Crossings—Study and submit report on the location of signs, including consideration of safety of employees using the roadway; prepare and submit specifications for highway grade crossings; study and report the various substitutes for wooden crossing planks for highway crossings and city streets; prepare and submit plans and specifications for round and square concrete fence posts; make a revised study of the relative economy of steel, wood and concrete fence posts, submitting the information in such form that relative economy can be determined on varying prices for the several kinds of posts, including statement of use of and results obtained from concrete posts by railroads; Maro Johnson, assistant engineer, Illinois Central, Chicago, Ill.

Signals and Interlocking—Report on methods of operation on single track protected by automatic block signals (a) with overlap; (b) without overlap; report on methods of handling trains by signal indications without train orders; formulate and submit simple but comprehensive rules for lighting drawbridges, economy of lighting and safety of operation considered, collaborating with committee 15; formulate and submit a uniform code of regulations and signals for the operation of drawbridges in all districts, collaborating with committee 15; W. J. Eck, signal & electrical superintendent, Southern Railway, Washington, D. C.

Records and Accounts—Submit proposed conventional signs for architectural details; H. M. Stout, record engineer, Northern Pacific, St. Paul, Minn.

Rules and Organization.—Prepare and report rules for conduct of bridge and building, signal, and telegraph and telephone work, to be added to the "Manual of Rules for the guidance of employees of the Maintenance of Way Department"; study and report on use of mechanical appliances and tools, with organization of labor involved, in maintenance of way work; W. C. Barrett, trainmaster, Lehigh Valley, Sayre, Pa.

Water Service—Study and report on pitting and corrosion of boiler tubes and sheets, character of metal, methods of manufacture, construction of boilers and quality of water considered; study and report on specifications for the various chemicals used in water treatment; study and report on centrifugal pumps for railway water service; A. F. Dorley, engineer maintenance of way, Missouri Pacific, St. Louis, Mo.

Yards and Terminals—No new subjects; A. Montzheimer, chief engineer, Elgin, Joliet & Eastern, Joliet, Ill.

Iron and Steel Structures—Collaborate with committee 10 on rules for lighting drawbridges; collaborate with committee 10 on a uniform code of regulations and signals for operation of drawbridges; O. E. Selby, principal assistant engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio.

Economics of Railway Location—Study and report on suitable units for comparing costs of maintenance of way, equipment and transportation; resume the study and revise to date the subject of railway locomotive power; study and report on methods of estimating power, speed, time and fuel consumption; A. S. Going, engineer of construction, Grand Trunk, Montreal, Canada.

Wood Preservation.—No new subjects; C. M. Taylor, superintendent treating plants, Philadelphia & Reading and Central Railroad of New Jersey, Port Reading, N. J.

Electricity—Study and report on overhead transmission and distribution line construction for railroad use and prepare plans and specifications for such construction, co-operating with the appropriate committees of the signal section and the telegraph and telephone division of the American Railway Association; collaborate with committee 16 on the economics of railway location as affected by the introduction of electric locomotives; Edwin B. Katte, chief engineer, electric traction, New York Central, New York City.

Uniform General Contract Forms—Submit form of agreement for private road crossings; for purchase of electricity; for the sale of electricity; to cover joint use of passenger station; to cover joint use of freight station; for trackage rights; private crossing at grade; W. D. Faucette, chief engineer, Seaboard Air Line, Norfolk, Va.

Economics of Railway Operation—Study and report on the economical operation of trains against the current of traffic on multiple track railroads; L. S. Rose, assistant to general manager, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio.

Economics of Railway Labor—No new subjects; C. E. Johnston, general manager, Kansas City Southern, Kansas City, Mo.

Shops and Locomotive Terminals—No new subjects; F. B. Morrow, chief engineer, Chicago & Western Indiana, Chicago.

THE MATERIAL MARKET

THE MUCH heralded reduction in the prices of United States Steel Corporation products has finally arrived, but instead of being an actual reduction, as announced by the newspapers, it is in effect really an advance in prices insofar as it concerns the consumer. This arises from the fact that for a number of months the independent manufacturers have been quoting prices appreciably lower than the base prices observed by the steel corporation. For instance, the established prices for plates, shapes and bars have been 2.65, 2.45 and 2.35 cents per lb., respectively, while the actual price at which these items have been sold in the last month or two has been two cents or even less. The new prices established by the steel corporation serve to split the difference between these limits and since the independent manufacturers have largely advanced their prices to meet the reductions by the corporation, the actual selling prices are really higher than they were a month ago. Because of this present uniformity of quotations but one set of prices is given in the table below instead of two, as in previous months. In view of the fact that there is at present but little demand for most classes of commodities, it will be interesting to note whether the manufacturers can maintain the new level of prices.

	Prices in Cents Per Pound			
	March 21		April 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	3.25 to 3.65	.... 4.03	3.65	4.03
Track bolts	.... 4.60	.... 4.98	4.60	4.98
Angle bars	.... 2.75	.... 2.75	....	2.75
Tie plates, steel	.... 2.75	2.75 to 3.00	....	3.00
Tie plates, iron	....	.... 3.00	....	3.00
Plain wire	3.00 to 3.25	3.38 to 3.63	3.25	3.63
Wire nails	3.00 to 3.25	3.38 to 3.63	3.25	3.63
Barbed wire, galv.	3.85 to 4.10	4.18 to 4.33	4.10	3.48
C. I. pipe, 6 in. or larger (per ton)	....	.... 64.10	....	64.10
Plates	1.95 to 2.65	2.38 to 3.03	2.20	2.58
Shapes	2.00 to 2.45	2.48 to 3.83	2.20	2.58
Bars (steel)	1.95 to 2.35	2.38 to 2.73	2.10	2.48

The scrap market has descended to even greater depths and prices are now just about half of what they were last October.

	Chicago	St. Louis
	Per Gross Ton	
Relaying rails	$30.00 to $32.50	$27.50 to $32.50
Rerolling rails	12.50 to 13.00	12.50 to 13.00
Rails less than 3 ft. long	12.50 to 13.00	12.50 to 13.00
Frogs and switches, cut apart	11.50 to 11.50	12.00 to 12.00
	Per Net Ton	
No. 1 railroad wrought	10.00 to 10.50	9.50 to 10.00
Steel angle bars	10.00 to 10.50	10.00 to 10.50

Lumber prices show some further reductions in nearly every item in the table below. As a measure of the progress of reductions it may be said that the decreases in prices since the first of the year have ranged from $1.50 to $12 per thousand for both Douglas fir and Southern pine items.

Southern Pine Mill Prices

	March	April
Flooring, 1 x 4, B. & B. flat	$33.30	$31.45
Boards, 1 x 8, 14 & 16, No. 1	26.04	23.82
Dimension, 2 x 4, 16, No. 1	21.47	20.89
Dimension, 2 x 10, 16, No. 1	21.86	22.41
Timbers, 4 x 4 to 8 x 8, No. 1	22.69	20.43
Timbers, 3 x 12 to 12 x 12, No. 1	29.88	29.93

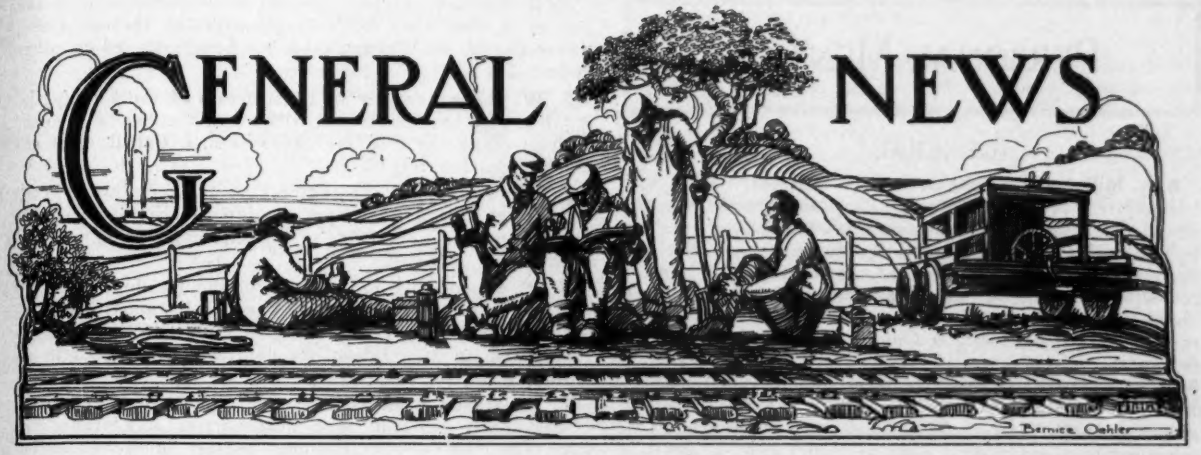
Douglas Fir, Seattle Prices

	March	April
Flooring, 1 x 4, No. 2 clear, flat	$23.00	$21.00
Boards, 1 x 6, 6 to 20, No. 1, common	13.50	11.50
Dimension, 2 x 4, 16, No. 1, common	13.50	12.50
Dimension, 2 x 10, 16, No. 1, common	13.50	12.50
Timbers, 6 x 6 to 8 x 8, No. 1, common	20.00	20.00
Timbers, 10 x 10 to 12 x 12, rough	21.00	18.00

The conditions which have served to stabilize cement prices are apparently still in effect, as recent changes are insignificant.

Prices of cement in carload lots, not including package, are given below:

Pittsburgh	$2.17	St. Paul	$2.41
Cleveland	2.43	Toledo	2.49
Detroit	2.43	Milwaukee	2.39
Indianapolis	2.43	Minneapolis	2.41
Chicago	2.17	Duluth	2.10



The American Association of Engineers will hold its seventh annual covention at the LaFayette hotel, Buffalo, N. Y., on May 9, 10 and 11.

The American Society for Testing Materials will hold its twenty-fourth annual meeting at the New Monterey hotel, Asbury Park, N. J., on June 20-24, inclusive. Monday, June 20, will be devoted to committee meetings, and the first session of the annual meeting will be held on Tuesday morning, June 21.

The lightest cars for their load carrying capacity ever built for heavy train service are now being constructed to the number of 500 by the Norfolk & Western for coal service between Pocahontas and other fields and the seaboard. The car weighs 53,500 lb. and has a rated capacity of 100 tons. It is a high-side gondola and has six-wheel trucks.

Herbert C. Hoover, member of President Harding's cabinet as secretary of the Department of Commerce, has resigned from the presidency of the Federated Engineering Societies. His reason given for this action is that he believed that his occupancy of an executive position in the national government made it out of place for him to serve as the head of an organization designed to further the special interest of one particular group of citizens.

Arrangements have been completed between the quartermaster general of the War Department and the finance officer of the department for expediting the payment of a large number of outstanding bills in favor of the railroads for past services in passenger and freight movement, as well as of current bills, which is expected to result in the payment of $10,000,000 to $15,000,000 to the roads by May 1. The government has owed the railroads some $20,000,000 on this account and owing to the reductions of forces being made by the government for purposes of economy, the finance office has until very recently been falling further behind in the preparation of these vouchers.

The predicament of the Canadian Government in its venture in government ownership and control is demonstrated most eloquently in the estimated financial results for the current year. There is now every indication that the deficit from the government owned and controlled railroads, which must be made up from the treasury of the Canadian government, will amount to $140,000,000. Not a single one of the roads earned its operating expenses, the operating ratio in the fiscal years of 1919-1920 ranging from 109 to 410 per cent. These ratios on the three most important systems of the Canadian Northern, the Canadian Government and the Canadian National were 112, 114.5 and 113 respectively.

The Louisville & Nashville has made application for an injunction to prevent the Railroad Commission of Louisiana from enforcing an order requiring the railroad to rebuild its gulf coast bridge over the Rigolets Pass and Chef Menteur. The application states that there is no public necessity for the new bridge, that the expenditure of money required is grossly out of proportion to the benefits to be derived, that the cost of the two bridges would be $2,300,000 and $1,300,000 respectively, and that the money could not be borrowed now except at prohibitive rates of interest.

The payroll of the railroads for 1920 aggregated $3,373,816,186. For the fourth quarter of last year the average compensation per employee was $159 per month. The average compensation for the year was $1,818 as compared with $1,004 in 1917. The average number of employees for the fourth quarter of 1920 was 2,136,259.

According to figures compiled by the Bureau of Foreign and Domestic Commerce, 4,630,222 lb. of track spikes, valued at $251,926, were exported during the month of January in addition to 59,739 tons of rails, valued at $3,906,441, and switches, frogs, splice bars, etc., valued at $1,161,126. Cuba received more of this equipment than any other country.

The application of the portable unit car which the New York Central is now using in express service has been extended to freight service, with a view to its ultimate application to store door delivery. A low-side gondola car is arranged to receive three or more containers, each having a capacity of 3,500 or 7,000 lb. These are transferred by cranes from the car to a truck or vice versa, so that a quantity of freight may be loaded in the container by the shipper, sealed, transferred to the car, carried over the road and again transferred to a truck and delivered to the consignee without breaking the seal of the container.

The Railway Terminal Commission of the City of Chicago has submitted a comprehensive report to the mayor and city council of that city, proposing a comprehensive plan for the complete reconstruction of all railway facilities between State street and the Chicago river immediately south of the business center of the city. This project contemplates the straightening of the Chicago river for a distance of about a mile, thus affording opportunity for the opening of a number of new north and south thoroughfare streets. The plan also proposes the abandonment of the present Dearborn, La Salle and Grand Central passenger stations with the idea that the raliroads which now use these stations will arrange for passenger facilities in the proposed new Illinois Central station at Twelfth street and Michigan avenue.

Final valuations were served on the Kansas City Southern, the Los Angeles & Salt Lake, the Atlanta, Birmingham & Atlantic and the Winston-Salem Southbound by the Interstate Commerce Commission on April 4. These valuations replace valuations previously served on these same railroads so as to prevent the original and present cost of condemnation and damages or of the purchase of land in excess of the original cost of present value. Besides this, figures were also presented to show the final values of these properties. This action is the result of the decision of the Supreme Court in the Kansas City Southern case last spring and as a consequence of which 55 tentative valuations heretofore served by the commission have been withdrawn so that the amounts for the costs of acquisition of carrier lands and for value of property may be added.

PERSONAL MENTION

GENERAL

A. A. Miller, district engineer on the Missouri Pacific, with headquarters at Kansas City, Mo., has been appointed superintendent of the Missouri division, with headquarters at Poplar Bluff, Mo., succeeding **W. C. Morse.** Mr. Miller was born at Zanesville, Ohio, on September 28, 1879, and received his education at the Ohio State University, graduating in 1902. He entered railway service in June, 1902, as a rodman on the Baltimore & Ohio at Wheeling, W. Va., and during the next five years served successively as assistant division engineer, assistant engineer and division engineer. From September, 1907, until June, 1909, he was chief engineer with the West Coast Company at Los Angeles, Cal., returning to railroad service on the latter date as assistant engineer on the Missouri Pacific, with headquarters at St. Louis, Mo. In June, 1911, he was promoted to division engineer, with headquarters at Kansas City, Mo., and in June, 1912, was transferred to Poplar Bluff, Mo. Five years later he was promoted to district engineer, with headquarters at Little Rock, Ark., and in August, 1918, was transferred with headquarters at Kansas City, Mo., which position he held at the time of his recent appointment.

J. A. McGrew has been appointed superintendent of maintenance of the Delaware & Hudson, with headquarters at Albany, N. Y., in charge of a newly organized maintenance department, effective April 1, which has been given jurisdiction over both the maintenance of way and structures and the maintenance of motive power and cars. The superintendent of maintenance is responsible for all maintenance work and reports to the general manager and directs the work of engineer maintenance of way, superintendent of motive power, master car builder, signal engineer and efficiency engineer. Mr. McGrew was born at Bridgewater, Ohio, on June 8, 1873, and graduated from the Ohio State University in 1895. He entered railway service in 1894 with the Columbus & Westernville Electric. Upon his graduation from college he became assistant superintendent of construction of that company and held that position until November, 1896, when he resigned to enter the engineering department of the Pennsylvania at Wellsville, O. From 1899 to 1901, he was assistant engineer, maintenance of way, at Logansport, Ind., and from 1901 to 1903 was engineer maintenance of way, with the same headquarters, being later transferred to Pittsburgh, Pa. For six months in 1904 he was special agent for the general manager of the Chicago, Rock Island & Pacific at Chicago. From 1904 to 1909 he was consulting engineer and contractor at Columbus, Ohio, and subsequently president of the National Engineering Company. He went with the Delaware & Hudson as inspector of maintenance on its lines, allied lines and controlled street railways, in September, 1909. Mr. McGrew was appointed superintendent of the Saratoga and Champlain divisions in 1910, and in July, 1917, entered the army as a consulting quartermaster in the construction division, later serving as a major of engineers in the railway division of the American Expeditionary Forces. He was discharged from the army on February 21, 1919, and returned to his position as superintendent on the Delaware & Hudson in April, 1920, which position he held at the time of his recent promotion.

ENGINEERING

C. R. Mee has been appointed chief engineer of the Louisiana Railway & Navigation Company, with headquarters at Shreveport, La.

F. P. Sisson, division engineer of the Grand Trunk, with headquarters at Detroit, Mich., has been transferred to Chicago.

E. K. Hatten has been appointed assistant engineer of the Georgia & Florida, with headquarters at Augusta, Ga. The office of chief engineer has been abolished.

R. D. Stewart has been appointed chief engineer of the Denver & Salt Lake, with headquarters at Denver, Colo., succeeding **V. B. Wagner,** who has been assigned to other duties.

C. W. Johns, engineer of construction of the Chesapeake & Ohio, with headquarters at Richmond, Va., has taken over, without change of title, the duties of **F. I. Cabell,** chief engineer, who has retired.

J. R. Sexton, regional engineer of the Erie, with headquarters at Chicago, has been appointed division engineer at Huntington, Ind., the office of regional engineer at Chicago having been abolished.

W. E. Rivers, division engineer of the Kamloops division of the Pacific district of the Canadian National Railways, with headquarters at Kamloops Junction, B. C., has been transferred to the Edson division, with headquarters at Edson, Alta.

C. T. Jackson, principal assistant engineer of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, has been appointed district engineer of the Southern district, with the same headquarters, succeeding **D. C. Fenstermaker,** who has been granted a leave of absence, effective April 16, to become associated with Peterson Brothers, contractors, Omaha, Neb., who will construct a new branch line in Cuba for the United Fruit Company.

Guy C. Dunn, office engineer in the chief engineer's office of the Canadian Northern, Eastern Lines, with headquarters at Toronto, Ont., has been appointed assistant to chief engineer of the Eastern Lines of the Canadian National, with the same headquarters. **R. B. Jennings,** division engineer of the Toronto division, with headquarters at Toronto, has been transferred to the Ottawa division, with headquarters at Ottawa, Ont., succeeding **T. E. A. Hall,** who has been transferred to the Montreal division, with headquarters at Montreal, Que., in place of **H. K. Morrison,** resigned to go into private business.

W. P. Hayes, whose promotion to division engineer of the Louisiana division of the Missouri Pacific, with headquarters at Monroe, La., was noted in the April issue, was born at St. Louis, Mo., on January 1, 1886. He received his education at St. Louis University and entered railway service as a rodman on the Missouri Pacific in 1906, later being promoted to instrumentman. From 1912 until 1914 he was engaged in reinforced concrete building construction in Chicago and Detroit and in 1915 returned to the Missouri Pacific as an instrumentman, serving successively on the Kansas and Nebraska divisions. He was promoted to assistant engineer of maintenance on the Joplin division in 1918 and was transferred to the Louisiana division in July, 1919, which position he held at the time of his recent promotion.

G. R. Barry, division superintendent of the Fort Wayne division of the Pennsylvania, with headquarters at Fort Wayne, Ind., has been appointed division engineer, with headquarters at Logansport, Ind., succeeding **F. M. Hawthorne,** who has been appointed assistant division engineer. **W. R. Hillary,** engineer maintenance of way, with headquarters at Toledo, has been appointed division engineer, with the same headquarters, succeeding **J. K. Sherman,** who has been transferred to Grand Rapids, Mich., succeeding **T. L. Doyle,** who has been appointed assistant division engineer, with the same headquarters. **R. G. Jones,** division engineer at Mansfield, has been appointed assistant division engineer at Fort Wayne. These changes have been brought about by the abolishment of the Northern Ohio division of the Northwestern region and the consolidation of the Mansfield and Fort Wayne divisions.

H. Schantl has been appointed chief engineer of the Missouri-Illinois, with headquarters at Bonne Terre, Mo. **C. E. Morrow** has been appointed assistant engineer, with headquarters at Sparta, Ill. Mr. Schantl was born at Fesstus, Mo., on September 8, 1876, and he was educated at Washington University, St. Louis, graduating in 1903. He entered railway service in September, 1906, as assistant engineer on the Mississippi River & Bonne Terre. In December, 1918, he was promoted to engineer maintenance of way,

and was serving in this position at the time of his appointment as chief engineer of the Missouri-Illinois.

George P. MacLaren, whose promotion to engineer maintenance of way of the Canadian National Railways, Eastern Lines, with headquarters at Toronto, Ont., was noted in last month's issue, was born at London, Ont., on April 4, 1878. He received his education at Huron College, London, Ont., and from 1896 until 1899 served an apprenticeship with McBride & Farncomb, Ontario, architects, engineers and land surveyors. From the summer of 1899 until September, 1900, he served consecutively as cranesman on a dredge, resident engineer, draftsman, rodman and transitman for various concerns, and on the latter date was appointed levelman on location on the Halifax & Southwestern. He held this position until January, 1901, when he was appointed city engineer of Sydney, N. S. From April, 1901, until November, 1906, Mr. MacLaren served as levelman, transitman, resident engineer and division engineer on the Halifax & Southwestern. Upon the completion of this road he was appointed division engineer on the Canadian Northern, with headquarters at Quebec, and in October, 1909, was transferred to Toronto, Ont. In November, 1911, he was promoted to district engineer of the North Bay district, which position he occupied until December, 1915, when he was appointed division engineer of the Ontario division. From June, 1916, until March, 1919, Mr. MacLaren served in the Canadian army in France and upon his return was appointed district engineer of the Ontario district of the Canadian National Railways, which position he held at the time of his recent promotion.

Coincident with the consolidation of divisions on the Chicago, Rock Island & Pacific, appointments and transfers have been made, effective May 1, as follows: **A. C. Bradley,** division engineer, with headquarters at Colorado Springs, Colo., has been transferred to the Chicago terminal, with headquarters at Chicago, succeeding **C. P. Richardson,** who has been appointed assistant engineer, with headquarters at Fairbury, Neb.; **G. Davis,** division engineer, with headquarters at Cedar Rapids, Iowa, has been transferred to Manley, Iowa, succeeding **H. T. Livingston,** who has been appointed master carpenter and division engineer on the Des Moines Valley division, with headquarters at Cedar Rapids, Iowa. Mr. Livingston succeeds **W. E. Heimerdinger,** who has been appointed office engineer, with the same headquarters. **B. A. Wait,** assistant engineer, with headquarters at Fairbury, Neb., has been appointed instrument man, with the same headquarters. **J. G. Bloom,** division superintendent, with headquarters at El Dorado, Ark., has been appointed division engineer, with headquarters at Colorado Springs, Colo., succeeding A. C. Bradley. **R. Leas,** assistant engineer, with headquarters at El Reno, Okla., has been appointed instrument man, with the same headquarters. **F. F. Tate,** assistant engineer, with headquarters at Amarillo, Tex., has been appointed instrumentman, with the asme headquarters. **W. E. Brown,** division engineer, with headquarters at El Dorado, Ark., has been appointed roadmaster, on the Nebraska division.

TRACK

J. Reid has been appointed roadmaster on the Grand Trunk Pacific, with headquarters at McBride, B. C., succeeding **W. Willis,** deceased.

J. LaPeen has been appointed roadmaster of the Montello district of the Southern Pacific, with headquarters at Montello, Nev., succeeding **A. L. Bachar,** assigned to other duties.

John Buck has been appointed supervisor of track on the Minneapolis & St. Louis, with headquarters at Conde, S. D., succeeding **George Teyro,** who has been transferred to Monmouth, Ill., in place of **J. R. Cummings,** resigned.

F. W. Fuller, roadmaster on the Northern Pacific, with headquarters at Dilworth, Minn., has been transferred to the First and Fifth subdivisions, with headquarters at Duluth, Minn., succeeding **G. M. DeLambert,** who takes Mr. Fuller's place at Dilworth.

C. A. Asher has been promoted to supervisor of track on the New York, New Haven & Hartford, with headquarters at Putnam, Conn., succeeding **Calvin Armstrong,** who has been transferred to Franklin, Mass. Mr. Armstrong succeeds **John Savage,** deceased.

C. E. Cherry, acting roadmaster on the Missouri Pacific, with headquarters at Auburn, Neb., has been appointed roadmaster on the Northern Kansas division in charge of the territory between Atchison and Greenleaf and the Washington branch, succeeding **W. F. Murray,** assigned to other duties.

A. P. Crosley, assistant supervisor on the Philadelphia & Reading, with headquarters at Trenton Junction, N. J., has been promoted to supervisor, with headquarters at Coatesville, Pa., succeeding **C. J. Lepperd. F. W. Bilitz,** assistant supervisor of the Wilmington and Columbia division, has been transferred to Trenton Junction, N. J., succeeding Mr. Crosley.

John A. Buck, whose appointment as supervisor of track on the Minneapolis & St. Louis, with headquarters at Conde, S. D., is noted elsewhere in these columns, was born at North Warren, Pa., on February 22, 1892. He received his education at Cornell University and entered railway service with the Great Northern as a rodman in 1913. In 1915 and 1916 he served as transitman on the Chicago, Burlington & Quincy and during most of 1917 he served in the same capacity on the Baltimore & Ohio. Mr. Buck was a special agent in the traffic department of that road from November, 1917, until March, 1918, when he became a second lieutenant of engineers with the American Expeditionary Forces. In 1919 he returned to the Great Northern as assistant to the roadmaster and in November, 1920, left this road to go with the Minneapolis, Northfield & Southern as a draftsman, which position he held at the time of his recent appointment.

BRIDGE

I. Verschelden, bridge and building master on the Canadian Pacific, with headquarters at Montreal, Canada, has been transferred to Farnham, Quebec, succeeding **H. M. Farmer,** transferred to the Laurentian division.

Dennison Fairchild, acting supervisor of bridges and buildings on the Northern Pacific, with headquarters at Seattle, Wash., has been promoted to supervisor of bridges and buildings, with headquarters at Duluth, Minn., succeeding **J. E. Hood,** resigned.

E. Anderson, bridge foreman on the Chicago, Burlington & Quincy, Western Lines, has been promoted to master carpenter, with headquarters at Wymore, Neb., succeeding **F. E. Kulp,** who retired on April 1 after 43 years of continuous service with the Burlington.

T. J. McGinty, bridge and building master of the Ottawa division of the Canadian National, with headquarters at Ottawa, Ont., has been transferred to the Superior division, succeeding **W. J. Coughlin,** assigned to other duties. **O. Kerr,** bridge and building master of the Toronto division, with headquarters at Toronto, Ont., has been transferred to the Ottawa division, succeeding Mr. McGinty.

C. E. Horrom has been appointed supervisor of bridges and buildings on the Western division of the Chicago & Alton, with headquarters at Slater, Mo., succeeding **George Meyers.** Mr. Horrom was born in Cass county, Illinois, in 1871, and entered railway service with the Chicago, Peoria & St. Louis as a section laborer in 1897. He was promoted to section foreman in 1899 and in 1904 was promoted to extra gang foreman. In 1905 he was transferred to the bridge department and in 1909 was promoted to foreman of a bridge gang. In 1914 he was promoted to master carpenter, in which capacity he had charge of bridges and buildings, and water service as well as signals. He held this position at the time of his recent appointment.

J. R. Andrews, whose promotion to chief inspector of bridges and buildings on the Norfolk & Western, with headquarters at Roanoke, Va., was noted in last month's issue, was born at Marion, Va., on February 21, 1862. Mr. Andrews entered railway service as a bridge carpenter on the Norfolk & Western on October 18, 1896, serving the railroad in that capacity until 1899, when he was promoted

to carpenter foreman. In 1904 he was promoted to master carpenter, with headquarters at Bluefield, W. Va., remaining in this position, though his title was subsequently changed to supervisor of bridges and buildings, until his recent promotion to chief inspector of bridges and buildings.

Walter D. Pearce, trainmaster on the Northern Pacific at Forsyth, Mont., has been returned to service as supervisor of bridges and buildings at Glendive, on account of a reduction in force.

PURCHASES AND STORES

A. Herrera, formerly purchasing agent of the National Railways of Mexico, with headquarters at Mexico City, has been reappointed to his former position.

H. C. Pearce, general purchasing agent of the Seaboard Air Line, has resigned to become director of purchases and stores of the Chesapeake & Ohio, with headquarters at Richmond, Va. **W. H. King, Jr.,** assistant to the vice-president in charge of operation of the Seaboard Air Line, has been appointed general purchasing agent, succeeding Mr. Pearce.

B. W. Griffeth, assistant general storekeeper on the New York Central at Collinwood, Ohio, has been appointed district storekeeper, third district, with headquarters at Collinwood, succeeding **F. J. McMahon,** who has been assigned to other duties in the stores department at the same point. **A. L. Prentice,** also assistant general storekeeper at Collinwood, has been appointed district storekeeper, with headquarters at Elkhart, Ind., succeeding **C. F. Heidenrich,** who has been transferred to Collinwood. **L. J. Green,** assistant general storekeeper at West Albany, N. Y., has been appointed storekeeper at Otis, N. Y., succeeding **F. C. Vroman. R. S. Huffman,** also assistant general storekeeper at West Albany, has been appointed district storekeeper, with headquarters at the same point, succeeding **J. H. Seim,** transferred. **J. F. Blasie** has been appointed district storekeeper at Depew, N. Y., succeeding **H. L. Grandy,** transferred.

OBITUARY

Charles W. Root, civil engineer and former railway builder, died in Ashland, Ore., on February 16. Mr. Root was born in Mantua, Ohio, in 1850, and from 1881 to 1886 was in the employ of the Oregon & California Railroad, later serving as locating and construction engineer with the Northern Pacific, the Oregon-Washington Railroad & Navigation Company, the Farehaven & Southern and the Western Pacific.

Rolla J. Parker, general manager of the Western Lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., who died in the Santa Fe Hospital at Topeka, Kan., on April 1, was a roadmaster for 10 years of his railway career. Mr. Parker was born on June 27, 1857, at Roscoe, Minn., and entered railway service in 1872 with the Chicago, Milwaukee & St. Paul. In 1884, after three years of service as a conductor on construction trains on the Northern Pacific, he entered the service of the Atchison, Topeka & Santa Fe and had been with this road continuously for 34 years. In May, 1887, he was promoted to division roadmaster and in December, 1892, was promoted to general roadmaster, with headquarters at Topeka, Kan. In 1897 Mr. Parker was advanced to superintendent, in which capacity he served on various divisions until 1905 when he was promoted to general superintendent, serving on several divisions until September, 1916, when he was promoted to general manager, which position he held when he died.

Rolla J. Parker

CONSTRUCTION NEWS

The American Niagara Railroad Corporation, which was recently incorporated, proposes to build a line from the New York Central near its junction with the Lehigh Valley at Tonawanda, N. Y., to connect with the proposed railroad and bridge of the Canadian Niagara Bridge Company which has been organized under an act of the Canadian Parliament.

The Atchison, Topeka & Santa Fe, which was noted in the April issue as accepting bids for the construction of a craneway building at Topeka, Kan., to cost approximately $13,000, has awarded a contract for this work to Joseph E. Nelson & Sons, Chicago. This company, in co-operation with the railroad Y. M. C. A. of Topeka, Kan., will also remodel the Y. M. C. A. building at Topeka and build an addition to cost about $25,000, and is now accepting bids for this work.

The Santa Fe Coast Lines has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a brick and steel blacksmith shop 80 ft. by 307 ft. at San Bernardino, Cal. The estimated cost is $150,000 and construction will commence at once.

The Canadian National is advertising for bids for the construction of a number of concrete structures in the Ontario district.

The Chicago, Milwaukee & St. Paul contemplates rebuilding its coaling station at Wabasha, Wis., which was recently destroyed by fire.

The Chicago Union Station Company has awarded a contract for the construction of a new railway mail terminal to R. C. Wiebolt, Chicago.

This company will shortly accept bids for a viaduct on Van Buren street between Canal street and the Chicago river.

The Cleveland, Cincinnati, Chicago & St. Louis contemplates the construction of an engine terminal at Jeffersonville, Ind.

The Grand Trunk contemplates improving its yard facilities at Pontiac, Mich.

The Green Bay & Western has applied to the Interstate Commerce Commission for a certificate authorizing the abandonment of its La Crosse branch, 6.38 miles, on the ground that it is being operated at a net loss.

The Illinois Central will shortly accept bids for building a viaduct over McLemore avenue, Memphis, Tenn.

The Illinois Central, which was announced in the April issue as contemplating the construction of a new 100-ft. turntable at Waterloo, Ia., has awarded the contract for this work to the Ellington-Miller Company, Chicago.

This company, which was also announced in the April issue as accepting bids for the construction of two bridges at Council Hill, Ill., to cost a total of $60,000, has awarded the contract for this work to the Gould Construction Company, Davenport, Ia.

The Interstate Railroad will shortly ask for bids for the construction of approximately 18 miles of single track line with passing tracks and an interchange yard. The proposed line will lead through mountainous country and will involve the construction of three tunnels.

The Long Island is preparing plans for grade crossing elimination at Far Rockaway, N. Y., to cost in excess of $2,500,000.

The Oklahoma-Southwestern, which is constructing a line from Bristow to Nuyaka, Okla., a distance of 24 miles, has completed the line from Bristow to the crossing of the Canadian river at Deep Fork, a distance of 20½ miles. The company has awarded a contract to Allhands & Davis, Okmulgee, Okla., for grading between Deep Fork and Nuyaka. The company contemplates extending its line south of Nuyaka to Okmulgee, a distance of 12 miles, upon completion of the present work.

The St. Louis-San Francisco is engaged in improving and extending its yards at Sapulpa, Okla., at a cost of $75,000. The company also contemplates additions to its passenger station at Sapulpa to cost about $85,000.

The Seboomook Lake & St. John, which is owned by the Great Northern Paper Company, Boston, has let a contract to J. T. Mullin, Bangor, Me., for the construction of a line 20 miles in length, from Seboomook Lake to St. John Lake, Maine. This line is all through forest land. The maximum gradient will be 2 per cent and the maximum curvature 6½ deg. All bridges will be of wood and there will be one pile trestle 1,100 ft. long. A roundhouse and repair shop will be built and some rolling stock and a few locomotives will be purchased.

The Spokane & British Columbia has received a certificate from the Interstate Commerce Commission authorizing this company to abandon its entire line from Danville to Republic, Wash., 36.3 miles.

The Texas & Pacific closed bids for the construction of bridges across Bayou-Plaquemine, La., on April 20.

This road, in co-operation with the International & Great Northern, will construct a new union station at Longview, Tex., in accordance with a recent order of the Texas State Commission.

A report of the Bureau of Safety of the Interstate Commerce Commission shows that wheel-burned rails are a source of danger. This was brought out in connection with the investigation of a derailment on the Baltimore & Ohio on December 11, 1919, as a result of a broken rail.

GUARANTY CERTIFICATES ISSUED

In addition to those mentioned in previous issues, the Interstate Commerce Commission has issued certificates to railroads for partial payments on account of their guaranty as follows:

Atlantic Coast Line	$ 2,400,000
Appalachicola Northern	38,000
Bennettsville & Cheraw	10,000
Big Fork & International Falls	25,000
Brownwood North & South	5,500
Central of Georgia	475,000
Charleston Terminal Co.	50,000
Chicago Junction	200,000
Chicago, Milwaukee & St. Paul	2,000,000
Chicago, Peoria & St. Louis	60,000
Chicago, St. Paul, Minneapolis & Omaha	850,000
Cumberland & Pennsylvania	60,000
Fort Worth & Rio Grande	210,000
Gainesville & Northwestern	7,000
Gainesville Midland	25,000
Georgia, Florida & Alabama	40,000
Georgia Northern	4,000
Gulf, Florida & Alabama	356,360
Gulf, Florida & Alabama	370,000
International & Great Northern	260,000
Kansas City, Clinton & Springfield	55,000
Knoxville, Sevierville & Eastern	99,540
Live Oak, Perry & Gulf	12,000
Minneapolis & St. Louis	100,000
Minneapolis, St. Paul & Sault Ste. Marie	1,400,000
Minnesota & International	150,000
Mobile & Ohio	375,000
Montana Western	3,000
Nashville, Chattancoga & St. Louis	150,000
New York Central	20,000,000
Oregon Electric	180,000
Oregon Trunk	40,000
Pacific Coast	30,000
Paris & Great Northern	27,500
Pittsburgh, Cincinnati, Chicago & St. Louis	4,000,000
Pittsburgh & Lake Erie	3,000,000
San Antonio & Aransas Pass	475,000
Spokane, Portland & Seattle	250,000
St. Louis-San Francisco	800,000
St. Louis-San Francisco of Texas	200,000
Sylvania Central	10,000
Texas Midland	100,000
Wabash	1,500,000
Wadley Southern	50,000
Western Allegheny	45,000
Wheeling & Lake Erie	455,000

SUPPLY TRADE NEWS

GENERAL

The Roberts & Schaefer Company has moved its office from the McCormick building to the Wrigley building, Chicago.

The Universal Crane Company, Cleveland, Ohio, has removed its plant from Cleveland to its new factory at Elyria, Ohio, construction on which has just been completed.

The Keller Pneumatic Tool Company, Grand Haven, Mich., will remove its Chicago branch to the main floor in the Transportation building, 624 South Dearborn street, Chicago.

The T. L. Smith Company has moved its entire general sales department and its personnel from the Old Colony building, Chicago, to the factory at 1125 Thirty-second street, Milwaukee, Wis.

The Southern Hardware & Supply Company, general sales agent for the Saunders car stopper, has appointed E. L. Ruby as eastern sales agent, with headquarters at 1338 Real Estate Trust building, Philadelphia, Pa.

The Standard Paint Company changed its corporate title to the Ruberoid Company on April 1. There will be no change in the management or policy of the company, whose general offices will remain at 95 Madison avenue, New York.

The Engineering Business Exchange announces the opening of a Southeastern branch with **Marshall O. Leighton**, consulting engineer of Washington, D. C., as director, and with offices in the McLachlen building. Associated with Mr. Leighton in carrying on the exchange will be A. C. Oliphant.

The Brown Hoisting Machinery Company, Cleveland, Ohio, has opened a southern office at 530 Whitney-Central building, New Orleans, La. The states of Texas, Louisiana, Mississippi, Alabama, Georgia and Florida will be covered from this office. **Charles H. White**, who has been with the Brownhoist company for a number of years, is manager of the new office.

The Air Reduction Sales Company has secured control of the National Carbide Corporation of Virginia, with a new plant at Ivanhoe, Va., and beginning May 1, 1921, will direct the policy and control the operation and sales of the Carbide Corporation. The Air Reduction Sales Company will move its executive offices on May 1 from 120 Broadway and 160 Fifth avenue to 342 Madison avenue, New York City. The district office of Airco after May 1 will be located at the Airco factory, 191 Pacific avenue, Jersey City, N. J.

PERSONAL

E. E. Goodwillie has been appointed sales agent in charge of the Cleveland office of the Bethlehem Steel Company, Bethlehem, Pa.

H. C. Brown, assistant general sales manager of the Chicago Bridge & Iron Company, with headquarters at Chicago, has been transferred to the New York office of the company.

D. T. Groff has been elected vice-president of the Jefferson Union Company, Lexington, Mass., and **C. E. Cook**, who was traveling representative, has been appointed sales manager.

H. G. Barbee, formerly in charge of eastern railroad sales of the Chicago Pneumatic Tool Company, has been appointed manager railroad sales, with headquarters in the Chicago Pneumatic building, 6 East Forty-fourth street, New York.

Dwight E. Robinson, until recently eastern railway representative of E. I. Du Pont de Nemours & Co., will become manager of the railway sales department of Breinig Brothers, Inc., manufacturers of paints and varnishes, Hoboken, N. J.

Wallace W. Glosser of the Maintenance Equipment Company, Chicago, has been appointed district sales manager of the Verona Tool Works, with headquarters at New York City. **W. C. Dawkins**, who has been associated with the

Verona Tool Works for some time, has been appointed assistant district sales manager at New York.

Victor T. Goggin, New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York, has severed his connection with that concern to become associated with Dwight P. Robinson & Company, Inc., of New York, as contracting engineer.

H. Kirke Porter, president of the H. K. Porter Company, Pittsburgh, Pa., died at his home in Washington, D. C., on April 10. He was born on November 24, 1840, at Concord, N. J., and studied at Newton Theological Institute and at Rochester Theological Seminary. He enlisted in the 45th Massachusetts Volunteers in 1862 and was mustered out of service in July, 1863. He then served in the United States Christian Commission, during the winter of 1864. In 1866 he became a member of the firm of Smith & Porter, manufacturing light locomotives. In 1871 the firm became Porter, Bell & Company and in 1879 was changed to H. K. Porter & Co., and was incorporated under the name of the H. K. Porter Company in 1899. This firm has been engaged in manufacturing heavy as well as light locomotives during the past 20 years and was the first concern to make compressed air locomotives for mine and general industrial use. Mr. Porter was a member of the 58th Congress from 1903 to 1905.

H. Kirke Porter

A. P. Van Schaick has been appointed general manager of sales of the Page Steel & Wire Company, New York, succeeding **E. C. Sattley,** resigned. **W. T. Kyle** has been appointed assistant general manager of sales. The headquarters of both Mr. Van Schaick and Mr. Kyle are at the Grand Central Terminal, New York. All the company's general sales are now handled at New York for both the Adrain, Mich., and Monessen, Pa., plants.

Mr. Van Schaick began his business career in 1903 in the railroad sales department of the Pittsburgh Plate Glass Company, with headquarters in Chicago. From 1906 until 1910 he was in the employ of the Universal Railway Supply Company, with headquarters in the same city, resigning that position during the latter year to become district sales manager of the Lackawanna Steel Company at Chicago. In May, 1919, he went to the American Chain Company, Inc., Bridgeport, Conn., as special representative, with headquarters in Chicago, and was subsequently appointed assistant general manager of sales of the same company at New York. On January 1, 1921, he was promoted to general manager of sales of the American Chain Company and other subsidiary companies and now becomes also general manager of sales of the Page Steel & Wire Company. Mr. Van Schaick has been active in the work of railway supply organizations and especially of the National Railway Appliances Association, of which he was elected a member of the executive committee in 1910, vice-president in 1911, and president the following year.

A. P. Van Schaick

Mr. Kyle was born at Baltimore, Md., in 1883, and began an apprenticeship course with the Bell Telephone Company, at Philadelphia, Pa., in 1901. Two years later he went with the American Pipe & Construction Company, Philadelphia, as district superintendent, on general railroad construction work. He left that position in 1908 to go to the Duplex Metals Company, New York, as a salesman, and later became sales manager of the same company. In 1914 he went to the Okonite Company as special representative at New York and in 1916 entered the service of the Page Steel & Wire Company as sales manager of its Armco wire department, which position he held at the time of his recent promotion. Mr. Kyle served in 1917 and 1918 as chairman of the Railway Signal Appliance Association and is now chairman of the Railway Telegraph & Telephone Appliance Association.

W. T. Kyle

TRADE PUBLICATIONS

Conservation.—The Lyster Chemical Company, New York, has issued a 16-page bulletin containing a general resume of the subject of timber preservation with particular reference to spray, brush and open tank treatments with creosote. The bulletin is illustrated with photographs of a great variety of structures that have been subjected to treatment.

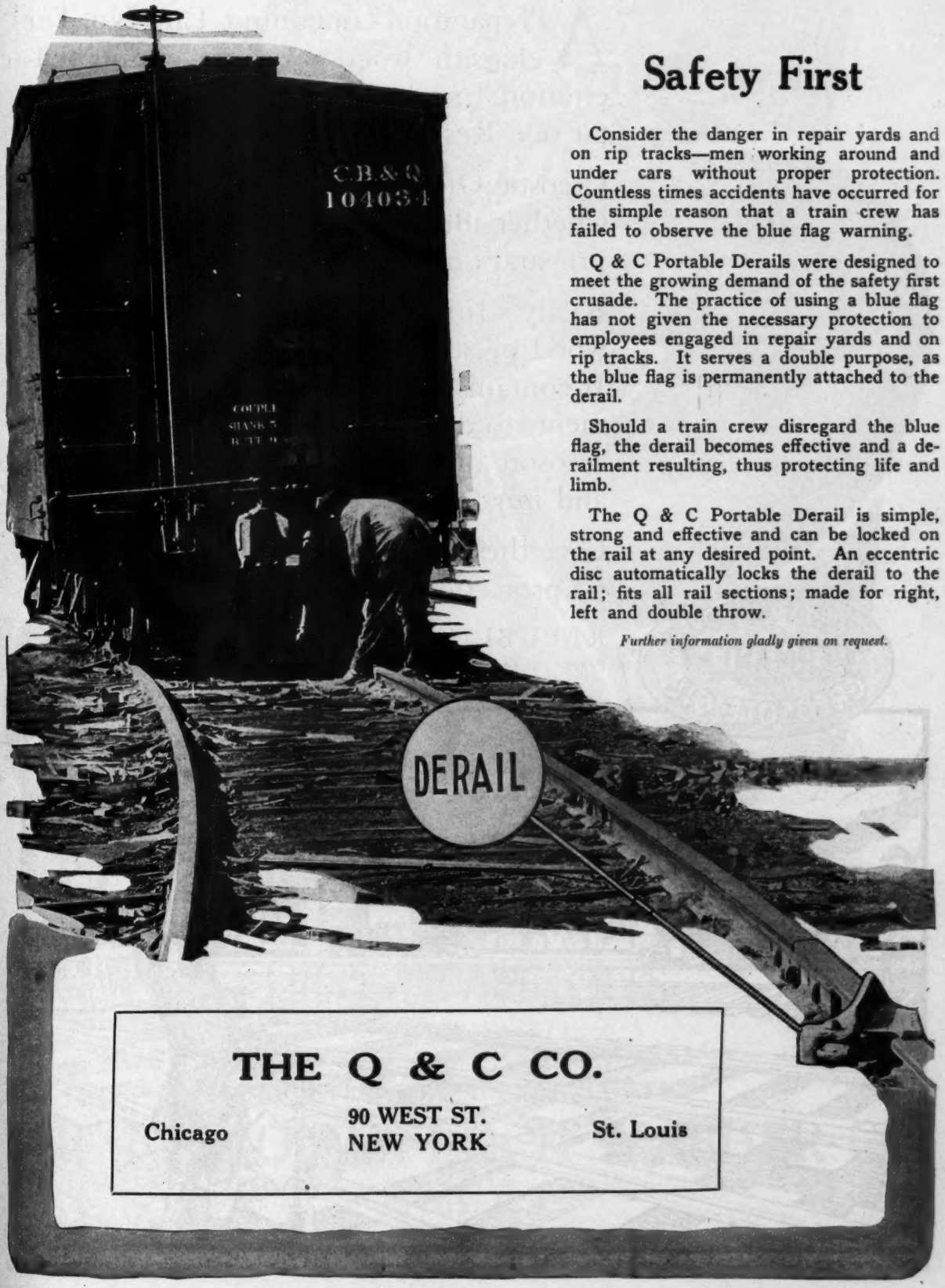
Spreader Plow.—The Bucyrus Company, South Milwaukee, Wis., has prepared an 8-page bulletin, SP-502, describing its Class 50 spreader plow and illustrating its appearance and the character of work performed. Information and a drawing are also given, showing a method of making a 31-ft. fill with the plow, without the use of trestle work.

From Tree to Trade.—A 48-page booklet under this title has been issued by the Long Bell Lumber Company, Kansas City, Mo., which describes the operations incident to the manufacture of lumber. This book is elaborately illustrated with photographs in color of the various steps incident to logging, sawing and distribution of lumber, poles, posts and similar products of wood.

Power Units for Movable Bridges.—In a four-page booklet issued by the Norwood-Noonan Company, Chicago, gasoline engine units for the operation of movable bridges are described and illustrated. Tables are given showing the principal dimensions, weights, capacities, speeds, etc., and there is also included a list of railroad bridges on which this type of equipment has been used.

Track Work.—The Ramapo Iron Works, Hillburn, N. Y., has recently issued a new catalogue of its products as a reference book for maintenance engineers. This book comprises about 500 pages and is printed on high-grade stock in loose-leaf form. It is devoted entirely to sectional, diagrammatic and halftone views of switchstands, switches, frogs, crossings, guard rails and accessories.

Water Softening Equipment.—The Graver Corporation, Chicago, has issued Bulletins 507 and 2C, containing illustrated descriptions of continuous type cold water softening systems for small water stations and quartz sand-pressure filters. Another new publication is Bulletin 506, a 24-page illustrated description of continuous softeners for large railroad stations. The latter bulletin also gives information on the conversion of existing water tanks into softeners and illustrates the adaptability of its system to conical bottom steel roadside tanks.



Safety First

Consider the danger in repair yards and on rip tracks—men working around and under cars without proper protection. Countless times accidents have occurred for the simple reason that a train crew has failed to observe the blue flag warning.

Q & C Portable Derails were designed to meet the growing demand of the safety first crusade. The practice of using a blue flag has not given the necessary protection to employees engaged in repair yards and on rip tracks. It serves a double purpose, as the blue flag is permanently attached to the derail.

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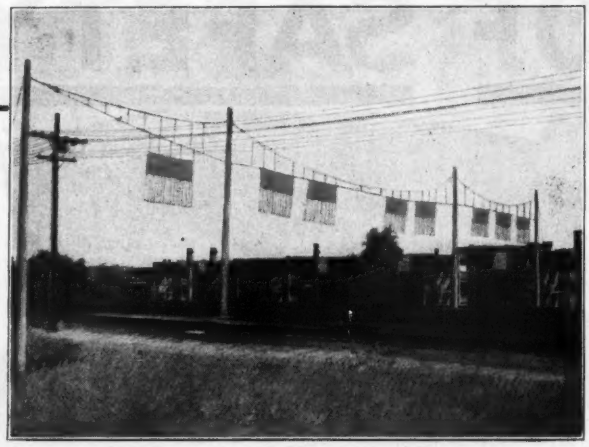

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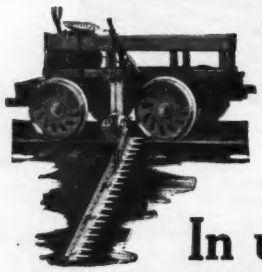

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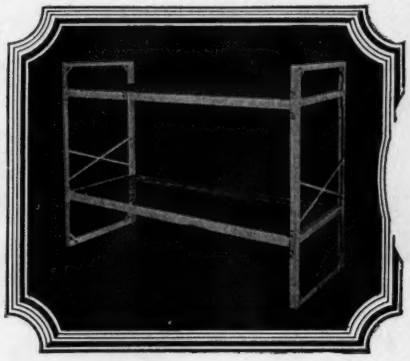

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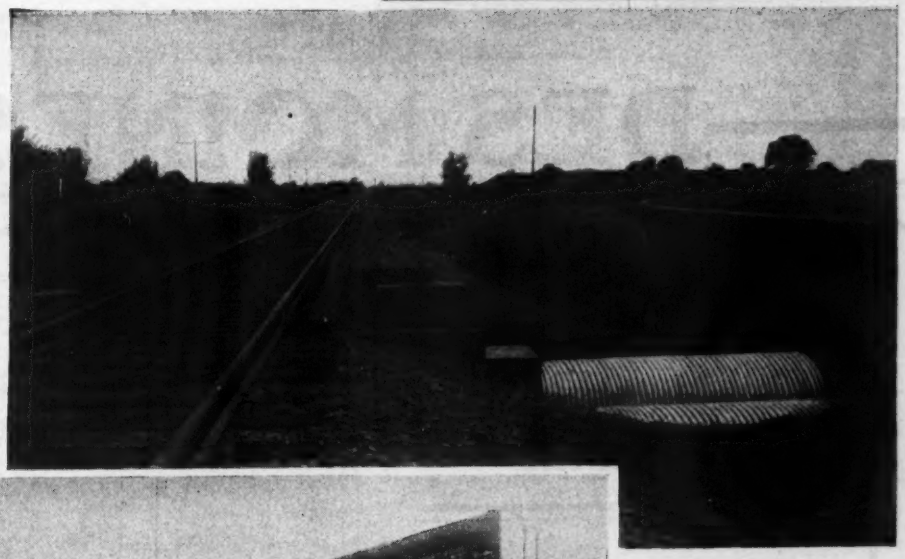

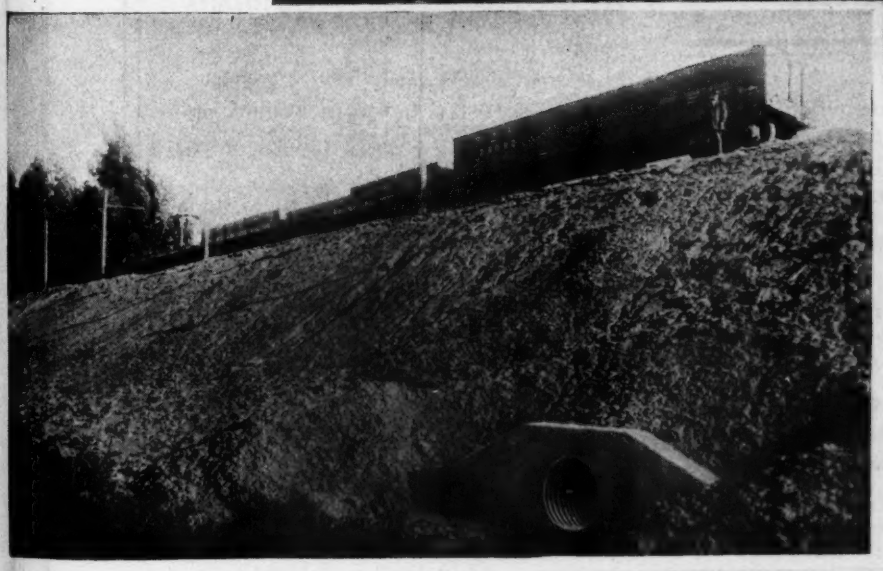

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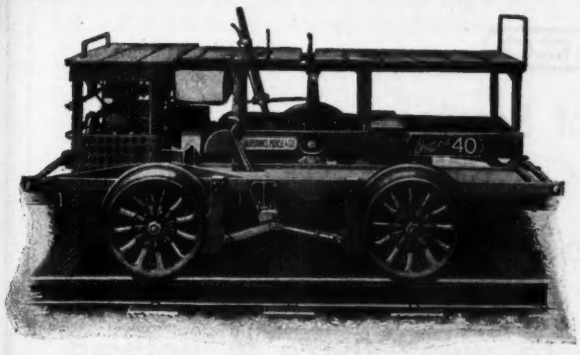

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Saint Paul Minnesota

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When the teeth of dippers or the dippers themselves become badly worn or broken the work stops or at best is carried on at a low pitch of efficiency.

For long life and resistance to wear there is nothing known that equals

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STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of the *Railway Maintenance Engineer*, published monthly at Chicago, Ill., for April 1, 1921.

State of New York } ss.
County of New York }

Before me, a notary public in and for the State and County aforesaid, personally appeared Edward A. Simmons, who, having been duly sworn according to law, deposes and says that he is the President of the Simmons-Boardman Publishing Company, publisher of the *Railway Maintenance Engineer*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., Transportation Building, Chicago, Ill.

Editor, Elmer T. Howson, Transportation Building, Chicago, Ill.

Managing Editor, W. S. Lacher, Transportation Building, Chicago, Ill.

2. That the owners are:

Owner — Simmons-Boardman Publishing Co., Woolworth Building, New York, N. Y. Stockholders holding 1 per cent or more of total amount of stock: Edward A. Simmons, Woolworth Building, New York; Lucius B. Sherman, Transportation Building, Chicago, Ill.; Henry Lee, Woolworth Building, New York; Samuel O. Dunn, Transportation Building, Chicago, Ill.; Roy V. Wright, Woolworth Building, New York; Elmer T. Howson, Transportation Building, Chicago, Ill.; Frederick H. Thompson, The Arcade, Cleveland, Ohio; Thomas Prosser & Son, P. O. Box 878, New York, N. Y.; Herbert L. Aldrich, 50 Central Park West, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDWARDS A. SIMMONS.

[SEAL]

Sworn to and subscribed before me this first day of April, 1921.

HERBERT E. MCCANDLESS.

Notary Public, Bronx County, Bronx County Clerk's No. 14, Bronx County Register's No. 2218; Certificate filed in New York County, Clerk's No. 168, Register's No. 2139; Commission expires March 30, 1922

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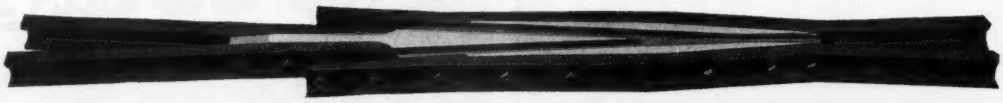

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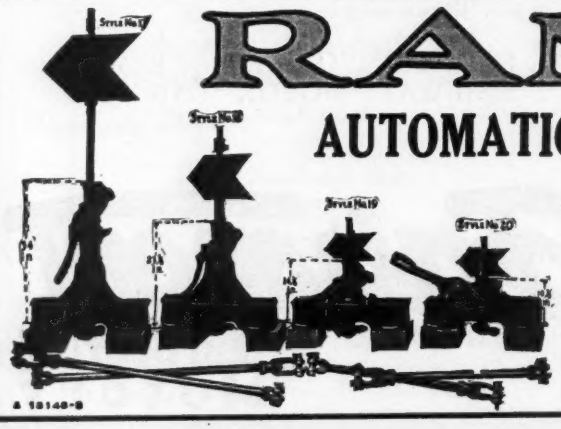

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Saw 42 inch will cut off 15 inch square timbers.

A dependable machine for use on the job or in the shop.

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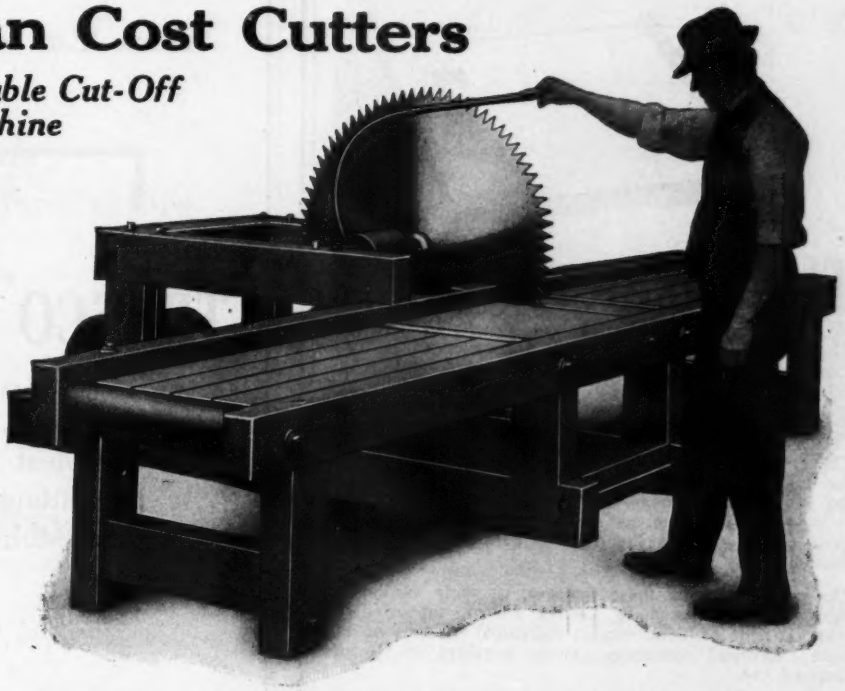
Full line of Woodworking and Saw Mill Machinery described in Catalog No. 20. Ask for it.



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The illustration shows our facilities for complete assembly under roof in our Frog and Switch Shops of special track work, insuring speed, accuracy and economy in final field installation.

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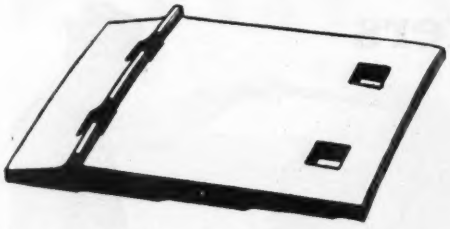

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The Lundie Tie Plate is widely acknowledged by railroad men having such plates in track, as promoting decided economy in rail wear, in holding track to gauge and in giving easy riding track. It will far more than pay for itself in reduction of Operating Expenses.

The features of the plate are—a sloping seat inclining the rail, so reducing abrasion and internal stresses in the rail to a minimum—a true camber promoting easy riding—and a bottom, as shown in the cut, so seating itself on the tie that the track is held firmly to gauge without injury to the tie.

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Maintenance forces can install the average railroad culvert without the use of any tools or rigging and without the slightest interruption to traffic.

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The well, compressor, re-lift booster, etc., are in the building shown above, which is 536 ft. from the 75,000 gal. tank.

Capacity of plant, 100 gals. per minute.

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is the ideal paint pigment for a protective covering for metal or wood surfaces.

It clings so tightly that there are no cracks or checks for moisture to enter.

Because of its fish-scale like formation, it successfully meets expansion and contraction.

No wonder it is considered indispensable by all users of it.

Its wonderful records extend back over 50 years.

Its success has encouraged imitations. Be sure you get Dixon's Silica-Graphite Paint. It has no equal for durability and real economy, and no competitor. Write for Booklet No. 187B and long service records.

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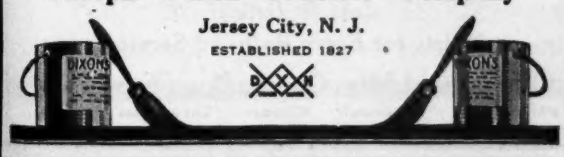

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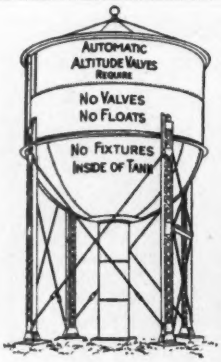

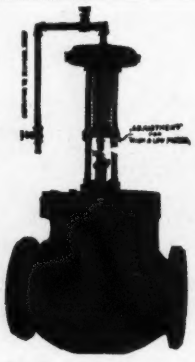

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Stop wasting water and keep a constant head on your distribution system by equipping all reservoirs, stand pipes and tanks with

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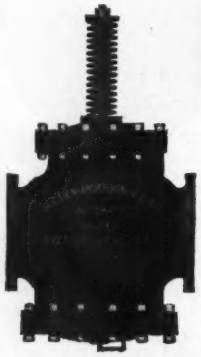
1.—Insure uninterrupted service and a positive water supply at all times.
2.—Prevent waste due to over-flow.
3.—Contain no floats or fixtures.
4.—Absolutely cushioned by both water and air in opening and closing. No banging, water hammer or burst mains.
5.—Can be opened and closed from distant points by simple electric solenoid attachment if desired.
6.—Can be made to work both ways to close automatically on a single pipe line in case of a break.
7.—Heavy construction throughout.



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1.—Maintain a constant terminal water pressure under all conditions.
2.—Positively cushioned by water and air in opening and closing.
3.—Valve closes slowly, eliminating all shock and water hammer.
4.—Can be furnished with electric feature to open valve to full area from distant points.

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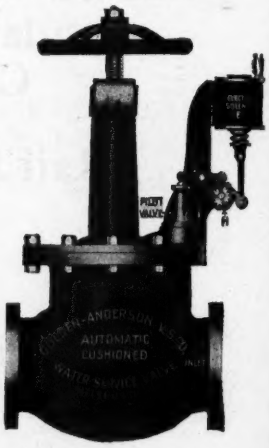
Pat. Cushioned-Water Service Valve "FOR FIRE SERVICE"

1.—Can be opened and closed instantly from distant points by electricity.
2.—Current is on only a few seconds, thereby preventing waste.
3.—Can be fitted with either d.c. or a.c. solenoid.
4.—Perfectly cushioned by water and air. Positively no metal to metal seating.
5.—Can be closed by hand.



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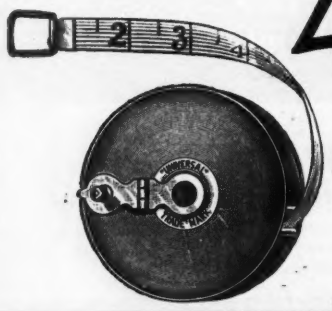

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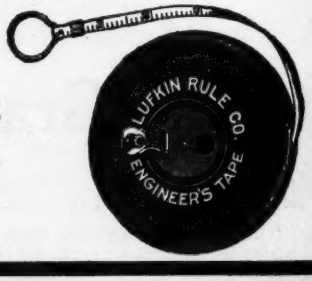

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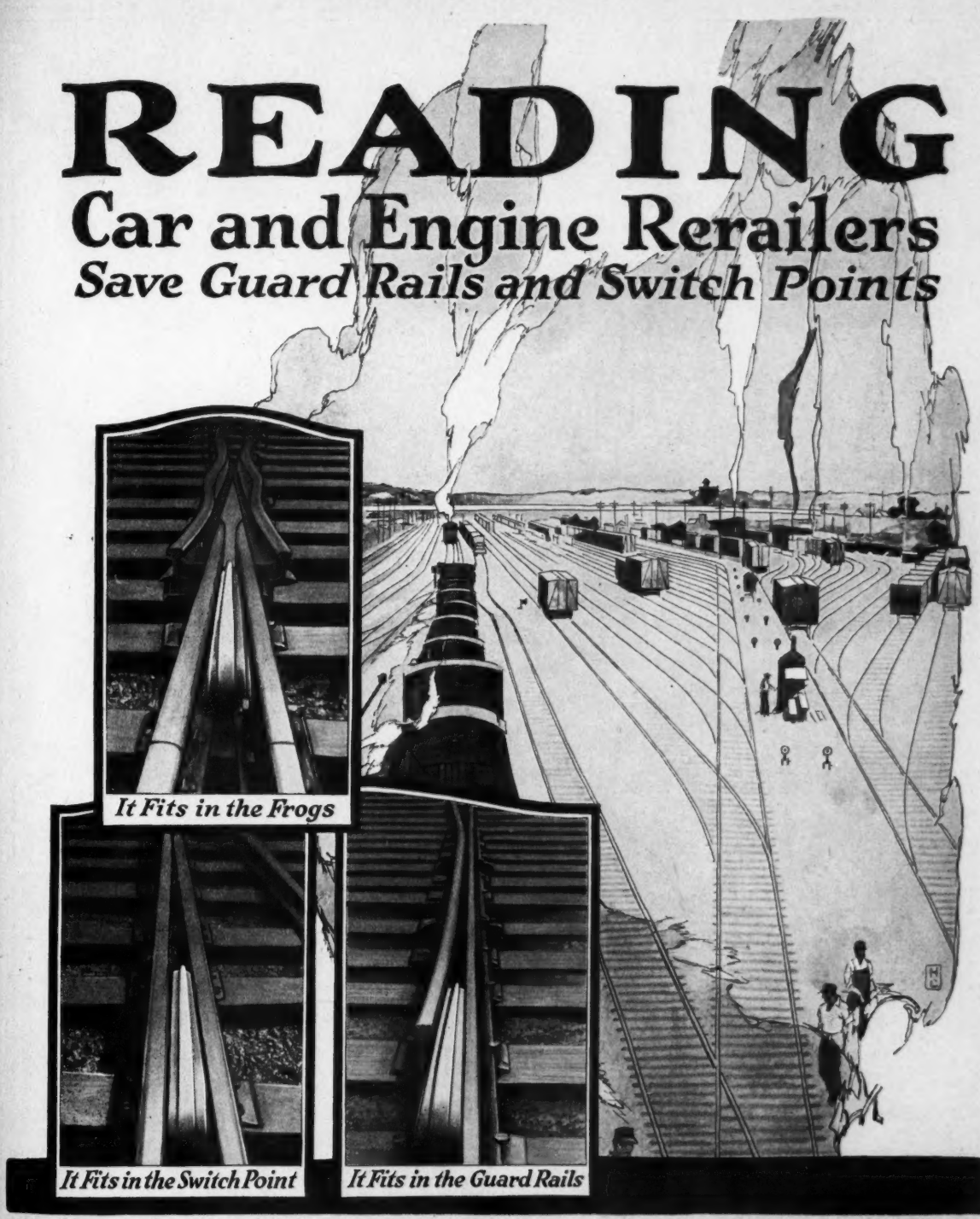

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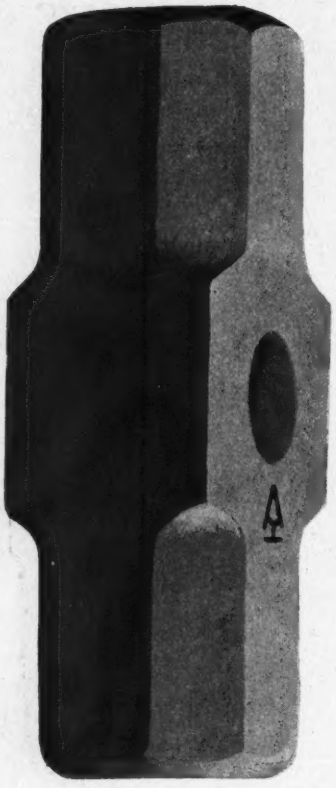

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